Draft Evaluation Using Distinguishing Characteristics

DRAFT EVALUATION USING DISTINGUISHING CHARACTERISTICS

Introduction

Eighteen characteristics have been identified that will be useful in distinguishing how the alternatives differ. The characteristics focus on the major differences in alternatives; differences that will be used in the selection of a draft preferred alternative. This recognizes that other parts of the alternatives are important but evaluation of their performance will not help select a draft preferred alternative. However, information on the performance of these other parts will also be available to the decision makers.

Draft Decision Matrix

The decision matrix is a one page summary of the evaluations for the eighteen distinguishing characteristics. Two forms of the decision matrix are provided for this draft review:

- One matrix (Figure 1) uses a series of shaded bars to indicate how the alternatives performs; the larger the bar, the more desirable the performance.

- Another matrix (Figure 2) shows the same results as numbers from 0 to 5; the larger the number, the more desirable the performance.

A blank matrix (Figure 3) is also provided for use as a worksheet to record ideas during review of the attached information. The draft decision matrix is followed by supporting information for each distinguishing characteristic.

The data used in the evaluations is preliminary in nature; more detailed evaluations are underway. In some cases, the evaluations are based on analytical information and in some cases are qualitative based on professional judgement. The information in the decision matrix and the supporting information will be updated as more information becomes available and CALFED agencies provide their input into the evaluations.

Scales

The supporting information for some distinguishing characteristics are measurements of adverse conditions and some are measurements of desirable conditions. For instance, one parameter used to evaluate export water quality is the level of bromide in the water. **"High"** levels of bromide would be given a **"low"** score on the above mentioned bar or number scales. One parameter used to evaluate water supply opportunity is the volume of environmental water in a critical year.

In this case **"high"** environmental water opportunity would be given a **"high"** score on the above mentioned scales.

However, the scales have been developed so the most desirable condition for each distinguishing characteristic is scored as a large bar for the first matrix and a "5" for the second matrix.

Preliminary Observations

Several of the eighteen distinguishing characteristics do not show significant differences between the alternatives with the current level of analysis:

- In-Delta Water Quality
- Storage and Release of Water
- Water Transfer Opportunities
- South Delta Access to Water (except for alternative variation 1A)
- Ability to Phase Facilities
- Brackish Water Habitat

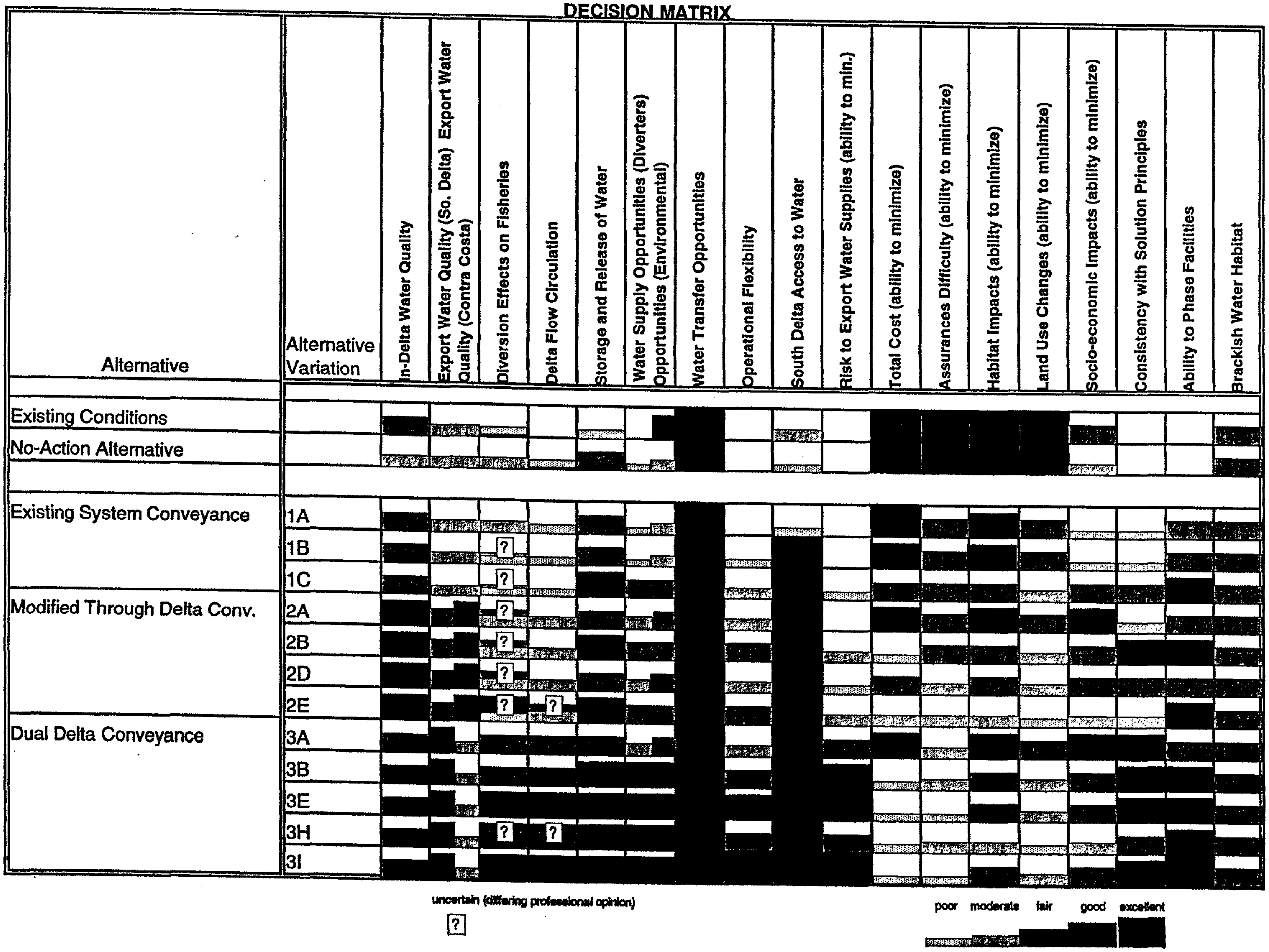
Four of the distinguishing characteristics show more differences but the absolute magnitude of the differences need more study:

- Assurances Difficulty
- Habitat Impacts
- Land Use Changes
- Socio-economic Impacts

The ones that show the **most significant differences** are:

- **Export Water Quality**
- **Diversion Effects on Fisheries**
- **Delta Flow Circulation (for fish transport)**
- **Water Supply Opportunities**
- **Operational Flexibility**
- **Risk to Export Water Supplies**
- **Total Cost**
- **Consistency with Solution Principles**

Figure 1
DRAFT DISTINGUISHING CHARACTERISTICS
DECISION MATRIX



E —0 1 5 4 3 4

E-015434

Figure 2

DRAFT DECISION MATRIX (Using Number Scoring)

Alternative		In-Delta Water Quality	Export Water Quality (So. Delta)	Export Water Quality (Contra Costa	Diversion Effects on Fisheries	Delta Flow Circulation	Storage and Release of Water	Water Supply Opportunities (Diverters)	Water Supply Opportunities (Environmental)	Water Transfer Opportunities	Operational Flexibility	South Delta Access to Water	Risk to Export Water Supplies (ability to min.)	Total Cost (ability to minimize)	Assurances Difficulty (ability to minimize)	Habitat Impacts (ability to minimize)	Land Use Changes (ability to minimize)	Socio-economic Impacts (ability to minimize)	Consistency with Solution Principles	Ability to Phase Facilities	Brackish Water Habitat
Existing Conditions		3	2	2	1	0	1	0	4	5	0	2	0	5	5	5	5	3	0	0	3
No-Action Alternative		2	2	2	2	1	3	1	2	5	0	1	0	5	5	5	5	2	0	0	3
Existing System Conveyance	1A	3	2	2	2	1	3	1	2	5	0	1	0	5	3	4	3	1	1	3	3
	1B	3	2	2	1-2	1	3	1	2	5	1	5	0	4	3	4	3	1	1	3	3
	1C	3	2	2	1-2	1	4	3	3	5	2	5	1	3	3	3	2	3	3	4	3
Modified Through Delta Conv.	2A	4	3	4	2-3	2	3	2	3	5	2	5	0	4	3	4	3	4	2	3	3
	2B	4	3	4	2-3	2	4	3	3	5	3	5	2	1	3	3	2	3	4	4	3
	2D	4	3	4	2-3	2	3	2	3	5	2	5	1	3	2	3	2	3	3	3	3
	2E	4	3	4	1-4	2-3	4	3	3	5	3	5	2	2	2	2	1	2	2	4	3
Dual Delta Conveyance	3A	3	4	2	3	3	3	2	3	5	2	5	3	4	2	4	3	4	4	3	3
	3B	3	4	2	3	3	4	4	4	5	3	5	4	1	2	3	2	3	4	4	3
	3E	3	4	2	4	4	4	4	4	5	4	5	5	1	1	3	2	3	4	4	3
	3H	3	4	2	3-4	3-4	4	4	4	5	3	5	3	1	2	2	1	2	3	4	3
	3I	3	4	2	4	4	4	4	4	5	5	5	5	1	1	3	2	3	4	5	3

Scoring from 0 to 5; **0 = lowest preference, 5 = highest preference**

0 1 2 3 4 5

E —0 1 5 4 3 5

E-015435

Figure 3
DECISION MATRIX (Blank Worksheet)

Alternative		In-Delta Water Quality	Export Water Quality (So. Delta)	Export Water Quality (Contra Costa	Diversion Effects on Fisheries (ability min.)	Delta Flow Circulation	Storage and Release of Water	Water Supply Opportunities (Diverters)	Water Supply Opportunities (Environmental)	Water Transfer Opportunities	Operational Flexibility	South Delta Access to Water	Risk to Export Water Supplies (ability to min.)	Total Cost (ability to minimize)	Assurances Difficulty (ability to minimize)	Habitat Impacts (ability to minimize)	Land Use Changes (ability to minimize)	Socio-economic Impacts (ability to minimize)	Consistency with Solution Principles	Ability to Phase Facilities	Brackish Water Habitat
Existing Conditions																					
No-Action Alternative																					
Existing System Conveyance	1A																				
	1B																				
	1C																				
Modified Through Delta Conv.	2A																				
	2B																				
	2D																				
	2E																				
Dual Delta Conveyance	3A																				
	3B																				
	3E																				
	3H																				
	3I																				

E-015437

Draft Distinguishing Characteristics

1 In-Delta Water Quality
2 Export Water Quality
3 Diversion Effects on Fisheries
4 Delta Flow Circulation
5 Storage and Release of Water
6 Water Supply Opportunities
7 Water Transfer Opportunities
8 Operational Flexibility
9 South Delta Access to Water
10 Risk to Export Water Supplies
11 Total Cost
12 Assurances Difficulty
13 Habitat Impacts
14 Land Use Changes
15 Socio-economic Impacts
16 Consistency with Solution Principles
17 Ability to Phase Facilities
18 Brackish Water Habitat

E-015437

1.
IN-DELTA WATER QUALITY

In-Delta Water Quality
Supporting Information

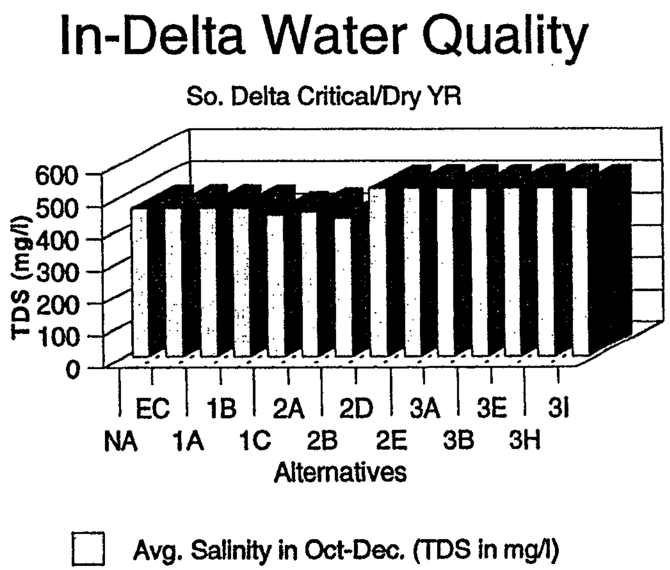
All alternatives include a program to reduce the total pollutant load entering the Delta and to manage the timing of pollutant discharges. The ecosystem and other water users will all benefit from this program. In-Delta water quality may further improve or degrade depending on the method of Delta conveyance and the water flows through the Delta. These conveyance and water flow changes primarily affect salinity levels and flow circulation, which can be used as a water quality indicator. Since all alternatives are based on operations criteria including the Delta standards, salinity levels critical to the environment will not vary significantly between alternatives. Therefore, the "In-Delta Water Quality" distinguishing characteristic does not include a measure of in-Delta ecosystem water quality. The characteristic is a measure of in-Delta water quality for those diverting and using water within the Delta.

Definition

"In-Delta Water Quality" provides a measure of **salinity** and **flow circulation** for four areas of the Delta. The measure focuses on water quality for in-Delta agricultural uses.

Summary

The western Detla salinity values vary significantly throughout the year. In general, the alternatives tend to slightly lower the salinity over the existing conditions and no-action alternative. The alternatives result in no significant change in salinity levels in the North or Central Delta. South Delta salinities increase somewhat with the alternatives, especially the alternative 3 variations. However, based on existing data, changes in salinity are relatively small. Alterantive 2 variations improve Delta circulation for water quality by providing an improved connection with the Sacramento River. Alternative 3 variations improve circulaiton by reducing reverse flow and recirculation of San Joaquin River flows. **The chart at the right provides one summary from Tables 1.1.1 thru 1.1.4. Since lower salinity is the most desirable, Table 1.1 provides a score of "5" to the lowest salinity and a score of "0" to the highest salinity.**



1. In-Delta Water Quality

Western Delta
- Salinity (TDS)
- Flow Circulation (qualitative assessment using DSM results)

South Delta
- Salinity (TDS)
- Flow Circulation (qualitative assessment using DSM results)

Central Delta
- Salinity (TDS)
- Flow Circulation (qualitative assessment using DSM results)

North Delta
- Salinity (TDS)
- Flow Circulation (qualitative assessment using DSM results)

To Decision Matrix

Table 1.1 Summary

Alternative	Western Delta: Salinity	Western Delta: Circulation	South Delta: Salinity	South Delta: Circulation	Central Delta: Salinity	Central Delta: Circulation	North Delta: Salinity	North Delta: Circulation	Overall Score
Exist. Cond.	**Slight reduction** in salinity levels with the alternative 2 and 3 variations	Alternative 2 variations improve circulation with more Sacramento River flow across Delta. Alternative 3 improve circulation by reducing flow recirculation of San Joaquin River flows.	**Slight increase** in salinity levels with the alternative 2 and 3 variations	Alternative 2 variations improve circulation with more Sacramento River flow across Delta. Alternative 3 improve circulation by reducing flow recirculation of San Joaquin River flows.	Salinity levels do change enough to differentiate between alternatives. (see following tables	Alternative 2 variations improve circulation with more Sacramento River flow across Delta. Alternative 3 improve circulation by reducing flow recirculation of San Joaquin River flows.	Salinity levels do change enough to differentiate between alternatives. (see following tables	Alternative 2 variations improve circulation with more Sacramento River flow across Delta. Alternative 3 improve circulation by reducing flow recirculation of San Joaquin River flows.	3
No-action									2
1A									3
1B									3
1C									3
2A									4
2B									4
2D									4
2E									4
3A									3
3B									3
3E									3
3H									3
3I									3

The above summarized changes are relatively small (see following tables). Therefore all alternatives score similarly with Alternative 2 variations providing slightly better in-Delta water quality.
Lower salinity is considered better.
More Delta circulation is considered better.
Values are on a scale from 0 to 5; with 5 representing the best water quality and 0 representing the worst.

Table 1.1.1 January-June Dry and Critical Year TDS Summary

Alternative	Jan-Mar Avg. TDS (mg/l) West	Central	South	North	Apr-Jun Avg. TDS (mg/l) West	Central	South	North
Exist. Cond.	370	200	500	110	270	120	400	100
No-action	370	200	500	110	270	120	400	100
1A	370	200	500	100	270	120	400	100
1B	370	200	500	100	270	120	400	100
1C	370	200	510	100	280	130	370	100
2A	240	120	510	100	240	120	380	100
2B	240	120	510	100	240	120	380	100
2D	230	120	510	100	230	120	430	100
2E	220	120	510	100	220	120	420	110
3A	250	220	510	100	220	180	420	110
3B	250	220	510	100	220	180	420	110
3E	290	260	510	100	220	220	480	110
3H	250	220	510	100	210	180	450	110
3I	290	260	510	100	220	220	480	110

Table 1.1.2 July-December Dry and Critical Year TDS Summary

Alternative	Jul-Sept Avg. TDS (mg/l) West	Central	South	North	Oct-Dec Avg. TDS (mg/l) West	Central	South	North
Exist. Cond.	1200	250	450	140	1170	280	460	130
No-action	1200	250	450	140	1170	280	460	130
1A	1200	250	450	140	1170	280	460	130
1B	1200	250	450	140	1170	280	460	130
1C	1200	250	460	140	1150	260	440	130
2A	1080	150	460	160	900	140	450	150
2B	1080	150	460	160	890	130	430	150
2D	1010	150	470	160	840	130	520	150
2E	930	140	470	160	770	130	520	130
3A	1080	170	470	160	1000	200	520	140
3B	1060	170	470	160	980	200	520	140
3E	1050	170	470	160	960	250	520	150
3H	1000	170	470	160	900	200	520	140
3I	1050	170	470	160	960	250	520	150

Table 1.1.3 January-June All Year TDS Summary

Alternative	Jan-Mar Avg. TDS (mg/l) West	Central	South	North	Apr-Jun Av. TDS (mg/l) West	Central	South	North
Exist. Cond.	270	180	360	110	210	120	310	100
No-action	270	180	360	110	210	120	310	100
1A	**270**	**180**	**360**	**110**	**210**	**120**	**310**	**100**
1B	270	180	360	110	210	120	310	100
1C	**270**	**180**	**360**	**110**	**210**	**130**	**300**	**100**
2A	200	130	360	110	180	120	310	100
2B	**190**	**130**	**360**	**110**	**180**	**120**	**310**	**100**
2D	**180**	**120**	**360**	**110**	**180**	**120**	**340**	**100**
2E	**180**	**120**	**360**	**110**	**180**	**120**	**340**	**100**
3A	220	200	360	110	180	150	350	100
3B	220	200	360	110	180	150	350	100
3E	**230**	**230**	**360**	**110**	**180**	**190**	**380**	**100**
3H	220	200	360	110	180	150	350	100
3I	230	230	360	110	180	190	380	100

Table 1.1.4 July-September All Year TDS Summary

Alternative	Jul-Sept Avg. TDS (mg/l) West	Central	South	North	Oct-Dec Avg. TDS (mg/l) West	Central	South	North
Exist. Cond.	900	210	410	120	980	260	420	120
No-action	900	210	410	120	980	260	420	120
1A	**900**	**210**	**410**	**120**	**980**	**260**	**420**	**120**
1B	900	210	420	120	980	250	410	120
1C	**890**	**210**	**430**	**120**	**970**	**240**	**400**	**120**
2A	780	130	430	140	730	130	390	140
2B	**780**	**130**	**430**	**140**	**730**	**130**	**390**	**140**
2D	**730**	**130**	**430**	**140**	**700**	**130**	**470**	**140**
2E	**670**	**130**	**430**	**140**	**640**	**130**	**470**	**130**
3A	750	150	430	140	760	220	450	130
3B	750	150	430	140	760	220	450	130
3E	**770**	**160**	**430**	**140**	**800**	**240**	**470**	**140**
3H	750	150	430	140	720	220	470	130
3I	770	160	430	140	800	240	470	140

Delta flow circulation can provide an indication of water quality with following considerations:

- Stagnation in the Delta interior can result in poorer water quality (local discharges make this situation worse)
- Recirculation of San Joaquin River flows down the DMC results in poorer water quality with return flows
- Reverse flow in Western Delta tends to pull in salinity
- Connection to Sacramento River tends to pull better water into the central Delta (cfs Georgiana, North & South forks of Mokelumne

Alternative	Delta Inflows	Exports	Stagnation	Recirculation	Reverse Flow	Connect to Sac (cfs)	Remarks
1A	High	High	0	Very high	0	7800	Alternative 2 variations provide more connection to the fresher Sacramento River Flows. Alternative 3 variations significantly reduce recirculation of San Joaquin
1C	High	High	0	Very high	0	7800	
2B	High	High	0	Very high	0	16100	
2D	High	High	0	Very high	0	16000	
2E	High	High	0	Very high	0	23000	
3E	High	High	Some	Low	0	6700	
1A	Medium	Low	0	Very high	0	3600	Alternative 2 variations provide more connection to the fresher Sacramento River Flows. Alternative 3 variations significantly reduce recirculation of San Joaquin
1C	Medium	Low	Some	High	0	3600	
2B	Medium	Low	Some	High	0	8300	
2D	Medium	Low	Some	High	0	8100	
2E	Medium	Low	Some	High	0	11200	
3E	Medium	Low	Some	Low	0	2900	
1A	Low	High	0	Very High	High	6100	Low inflow and high export is an infrequent occurrence; therefore, discount this condition for all
1C	Low	High	Some	High	High	6100	
2B	Low	High	Some	High	Some	9800	
2D	Low	High	Some	High	Some	9800	
2E	Low	High	Some	High	Some	9200	
3E	Low	High	Some	Moderate	0	1400	
1A	Low	Low	0	High	0	4500	Little distinction between alternative variations with low inflow and low export
1C	Low	Low	Some	High	0	4500	
2B	Low	Low	Some	High	0	4900	
2D	Low	Low	0	High	Some	5200	
2E	Low	Low	0	High	Some	5500	
3E	Low	Low	0	High	0	4000	

E—015443

Supporting Information for Table 1.1

In-Delta water quality will vary with the storage and conveyance facilities. Preliminary Delta Simulation Model (DSM) runs provide an indication of in-Delta water quality for the various alternatives. These runs provide an initial evaluation of flow, circulation, and salinity as total dissolved solids (TDS) contained in *Status Reports on Technical Studies for the Storage and Conveyance Refinement Process, Delta Simulation Model Studies of Alternatives 1A, 1C, 2B, 2D, 2E, 3E, August 4, 1997.* Simulations were conducted for the hydrologic simulation period 1976-1991. TDS predictions were presented for mean monthly tidally-averaged values over the hydrologic period. Since the DSM model is not yet linked with DWRSIM, the evaluations consider only at the change due to Delta conveyance. Future runs will also include TDS changes due to the different hydrology between the alternatives. ***This provisional data supporting Table 1.1 and supporting tables tend to over estimate the TDS concentrations. These will be revised in future model runs.***

Total dissolved solids (mg/l) estimates are summarized separately for each quarter of the year; first quarter (January, February, March); second quarter (April, May, June,); third quarter (July, August, September); and fourth quarter (October, Novemeber, December). This data is summarized or all 16 years of the simulation and for the dry and critical year types. The average of TDS at Emmaton and Jersey was used for the **Western Delta**. The average of Old River at Middle River, Old River at Tracy Road, and San Joaquin River at Brandt Bridge was used for the **Southern Delta**. The average of San Andreas Landing, Terminous, Prisoner's Point, and Old River at Rock Slough was used for the **Central Delta**. The average of Rio Vista and Green's Landing was used for the **Northen Delta.**

Average salinity estimates by quarter for dry/critical year types are shown in Tables 1.1.1 and 1.1.2. Average salinity estimates by quarter for all year types are showm in Tables 1.1.3 and 1.1.4. The provisional salinity data for the 6 modeled alternatives are shown in **bold** numbers in the tables. Salinity values for the other alternatives were estimated based on professional judgement and the modeled data and are shown as smaller fonts in the tables.

Western Delta Salinity

Current estimates of west-Delta water quality show that during summer months (July through September) salinity levels of source water can be as high as 1200 ppm. During this period, some late season field crops, such as corn or some vegetables, may be receiving final irrigations. The CALFED alternatives potentially improve the salinity of the source water by as much as 200 ppm. This can be

E-015445

beneficial to growers in the western-Delta who may be able to take advantage of the slightly improved quality for production of late season crops.

Reduced salinity of the source water can also reduce the amount of water applied to fields. This is a direct result of decreased leaching requirements. Benefits in the form of reduced agricultural drainage may also occur, since less leaching translates to less drainage needing to be pumped back off the island.

To the extent that high salinity in the summer months has discouraged planting of some crops types or varieties, improved salinity levels may result in slight shifts in cropping patterns. For instance, early maturing grain crops may be replaced by corn or other moderately salt tolerant row crops. However, the any shift in cropping resulting from water quality improvements is expected to be minor.

Southern Delta Salinity

The salinity levels estimated to occur as a result of a the various CALFED alternatives are not anticipated to create adverse impacts for local Delta agricultural uses. As shown on the table, south-Delta water quality ranges by alternative, but generally results in similar salinity levels in comparison to existing conditions. The exception, however, is for a few alternatives during the spring (April through June) and fall (October through December) months. In the spring, existing salinity is 400 ppm. This rises to as much as 480 ppm under alternatives 3E and 3I. In the fall, existing salinity levels of 460 ppm are shown to possibly increase to as much as 520 ppm. (Is this a major concern to south-Delta agricultural interests?)

Typically, salinity levels that exceed 450 to 500 ppm can begin to have a yield reducing impact on some of the more salt sensitive irrigated crops. However, when salts are adequately leached out of the rootzone, this impact is minimize or even non-existent. In the Delta, water supplies are ample, though maybe of undesirable stage or quality, and water is available for adequate leaching to counter-effect the potential impact of slightly higher saline water. Moreover, when the conditions in the south-Delta for the spring are compared with the existing conditions for the summer months (July through September), the increased salinity of the spring months seems to become less of an issue. However, it is in the spring, when planting and germination generally occur, that salinity can potentially have a negative impact on more salt sensitive crops.

Generally, it is anticipated that sufficient quantities of water will be available in adjacent channels and sloughs to the south-Delta irrigators such that any possible adverse impact from slightly increased salinity levels will be minimized through minor additional

E-015445

leaching. It is understood that to obtain additional leaching, more water may have to be pumped onto and off of Delta islands. To the extent that the minor shifts in salinity drive a need for additional leaching, there will be an associated increase in pumping costs.

Central Delta Salinity

Central Delta salinity levels are generally lower with the alternative 2 variations. However, the salinity levels (generally less than 250 mg/l) is good for all alternatives and therefore does not distinguish between alternatives.

Northern Delta Salinity

The Northern Detla salinity (generally less than 200 mg/l) levels is good for all alternatives and therefore does not differentiate between alternatives.

Delta Circulation

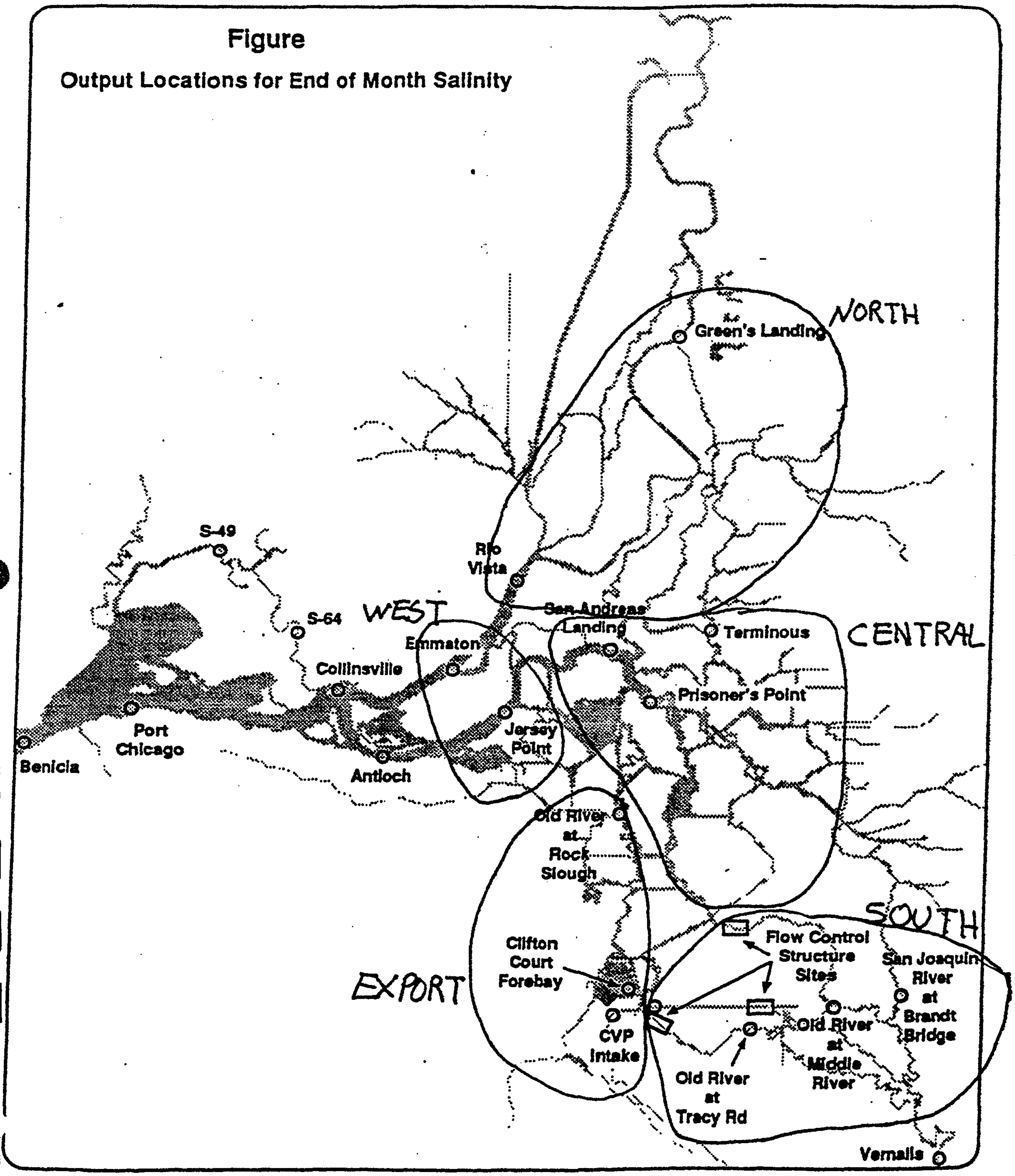
Rankings in Table 1.1 for Delta circulation were estimated from the circulation vectors in the previously mentioned report. In general, circulation was improved the most with the alternative 2 variations. The alternative 3 variations generally improved Delta circulation over that with existing channels. The alternative 3 variations generally did not have Delta circulation comparable with the alternative 2 variations due flow in the isolated facility and resultant reduced Delta flow. These are vary preliminary assessments since the detailed modeling work is continuing.

These evaluations of in-Delta water quality will come from the impact analysis for the EIR/EIS and from workgroups of experts. Since development of this information is in progress, the following is a sample of the types of information that may ultimately support Table 1.1.

Information in Table 1.1 and this supporting information will be updated as more detailed modeling becomes available.

Figure

Output Locations for End of Month Salinity



2.
EXPORT WATER QUALITY

Export Water Quality
Supporting Information

All alternatives include a program to reduce the total pollutant load entering the Delta and to manage the timing of pollutant discharges. The ecosystem and other water users will all benefit from this program. Export water quality may further improve or degrade depending on the method of Delta conveyance and the water flows through the Delta. The main uses of exported water is for agricultural, municipal, and industrial uses.

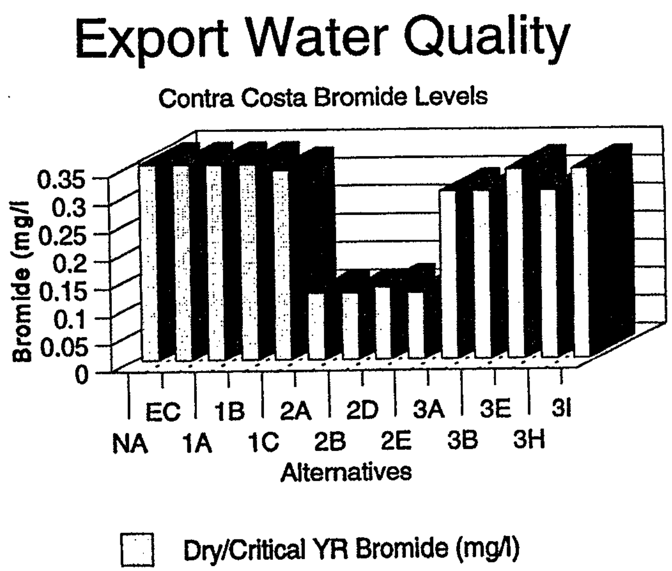
Definition

"Export Water Quality" provides a measure of salinity, bromide, and total organic carbon for four export diversion locations from the Delta. The measure focuses on municipal/industrial uses for the North Bay Aqueduct and Contra Costa Intake and for agricultural and municipal/industrial uses for the SWP and CVP export pumps.

Summary

The salinity, bromide, and total organic carbon vary significantly for the various export locations within the Delta. In general, the alternative 2 variations provide the best export water quality for the Contra Costa Canal diversion. Alternative 3 variations provide the best water quality for the SWP and CVP south Delta export diversions. Alternative 1 variations provide marginally better water quality for the North Bay Intake.

The chart at the right provides one summary from Tables 2.1. Since lower bromide is the most desirable, Table 2.1 provides a score of "5" to the lowest bromide levels and a score of "0" to the highest bromide levels.



E-015449

2. Export Water Quality

North Bay Aqueduct
- Salinity (TDS)
- Bromide (estimate from DSM)
- TOC (DWR disinfection byproducts model)

Contra Costa Canal Intake
- Salinity (TDS)
- Bromide (estimate from DSM)
- TOC (DWR disinfection byproducts model)

SWP Export Pumps
- Salinity (TDS)
- Bromide (estimate from DSM)
- TOC (DWR disinfection byproducts model)

CVP Export Pumps
- Salinity (TDS)
- Bromide (estimate from DSM)
- TOC (DWR disinfection byproducts model)

To Decision Matrix **To Decision Matrix**

Table 2.1 Summary, All Years

	North Bay (mg/l)			Contra Costa (mg/l)			SWP Export (mg/l)			CVP Export Pumps (mg/l)			S. Delta	Contra C.
Alternative	TDS	Bromide	TOC	TDS	Bromide	TOC	TDS	Bromide	TOC	TDS	Bromide	TOC	Score	Score
Exist. Cond	190	0.05	5.6	300	0.35	3.6	260	0.25	4	310	0.33	4	2	2
No-action	190	0.05	5.6	300	0.35	3.6	260	0.25	4	310	0.33	4	2	2
1A	190	0.05	5.6	300	0.35	3.6	260	0.25	4	310	0.33	4	2	2
1B	190	0.05	5.6	300	0.35	3.6	260	0.25	4	310	0.33	4	2	2
1C	190	0.05	5.6	290	0.34	3.5	280	0.28	4.3	280	0.28	4.3	2	2
2A	190	0.05	5.9	160	0.12	4.2	200	0.15	4.4	200	0.15	4.4	3	4
2B	190	0.05	5.9	160	0.12	4.2	200	0.15	4.4	200	0.15	4.4	3	4
2D	190	0.05	5.9	170	0.13	4.2	200	0.16	4.3	200	0.16	4.3	3	4
2E	190	0.05	5.7	160	0.12	3.4	200	0.15	4.2	200	0.15	4.1	3	4
3A	190	0.05	5.9	270	0.3	5	160	0.07	2.5	160	0.07	2.5	4	2
3B	190	0.05	5.9	270	0.3	5	160	0.07	2.5	160	0.07	2.5	4	2
3E	190	0.05	5.9	290	0.34	5.5	140	0.06	2.3	140	0.06	2.3	4	2
3H	190	0.05	5.9	270	0.3	5	160	0.07	2.5	160	0.07	2.5	4	2
3I	190	0.05	5.9	290	0.34	5	140	0.06	2.5	140	0.06	2.5	4	2

Lower salinity, bromide, and TOC indicate better water quality and will be provided higher rankings.

0 = poorer water quality, 5 = highest water quality

Since preliminary modeling showed that North Bay Aqueduct water quality is unchanged by the alternatives, actual data for 1990-1996 was used for the North Bay TDS and bromide columns

Table 2.1 Summary, Critical Years (for comparison only)

	North Bay (mg/l)			Contra Costa (mg/l)			SWP Export (mg/l)			CVP Export Pumps (mg/l)			S. Delta	Contra C.
Alternative	TDS	Bromide	TOC	TDS	Bromide	TOC	TDS	Bromide	TOC	TDS	Bromide	TOC	Score	Score
Exist. Cond				510			370			410				
No-action				510			370			410				
1A				**510**			**370**			**410**				
1B				510			370			410				
1C				**480**			**400**			**400**				
2A				210			220			220				
2B				**210**			**220**			**220**				
2D				**220**			**240**			**240**				
2E				**210**			**230**			**230**				
3A				300			180			180				
3B				300			180			180				
3E				**390**			**150**			**150**				
3H				300			180			180				
3I				390			150			150				

Supporting Information for Table 2.1

In-Delta water quality will vary with the storage and conveyance facilities. Preliminary Delta Simulation Model (DSM) runs provide an indication of in-Delta water quality for the various alternatives. These runs provide an initial evaluation of flow, circulation, and salinity as total dissolved solids (TDS) contained in *Status Reports on Technical Studies for the Storage and Conveyance Refinement Process, Delta Simulation Model Studies of Alternatives 1A, 1C, 2B, 2D, 2E, 3E, August 4, 1997.* Simulations were conducted for the hydrologic simulation period 1976-1991. TDS predictions were presented for mean monthly tidally-averaged values over the hydrologic period. Since the DSM model is not yet linked with DWRSIM, the evaluations consider only at the change due to Delta conveyance. Future runs will also include TDS changes due to the different hydrology between the alternatives. ***This provisional data supporting Table 1.1 and supporting tables tend to over estimate the TDS concentrations. These will be revised in future model runs.***

Municipal & Industrial Water

Total dissolved solids (mg/l) estimates are summarized at each export location as the primary indicators of export water quality. Bromide levels less than 50 ug/L are preferable for drinking water and will be given the highest score. Bromide levels higher than 500 ug/L will be given the lowest score. Table 2.1 shows estimates of salinity and bromides.

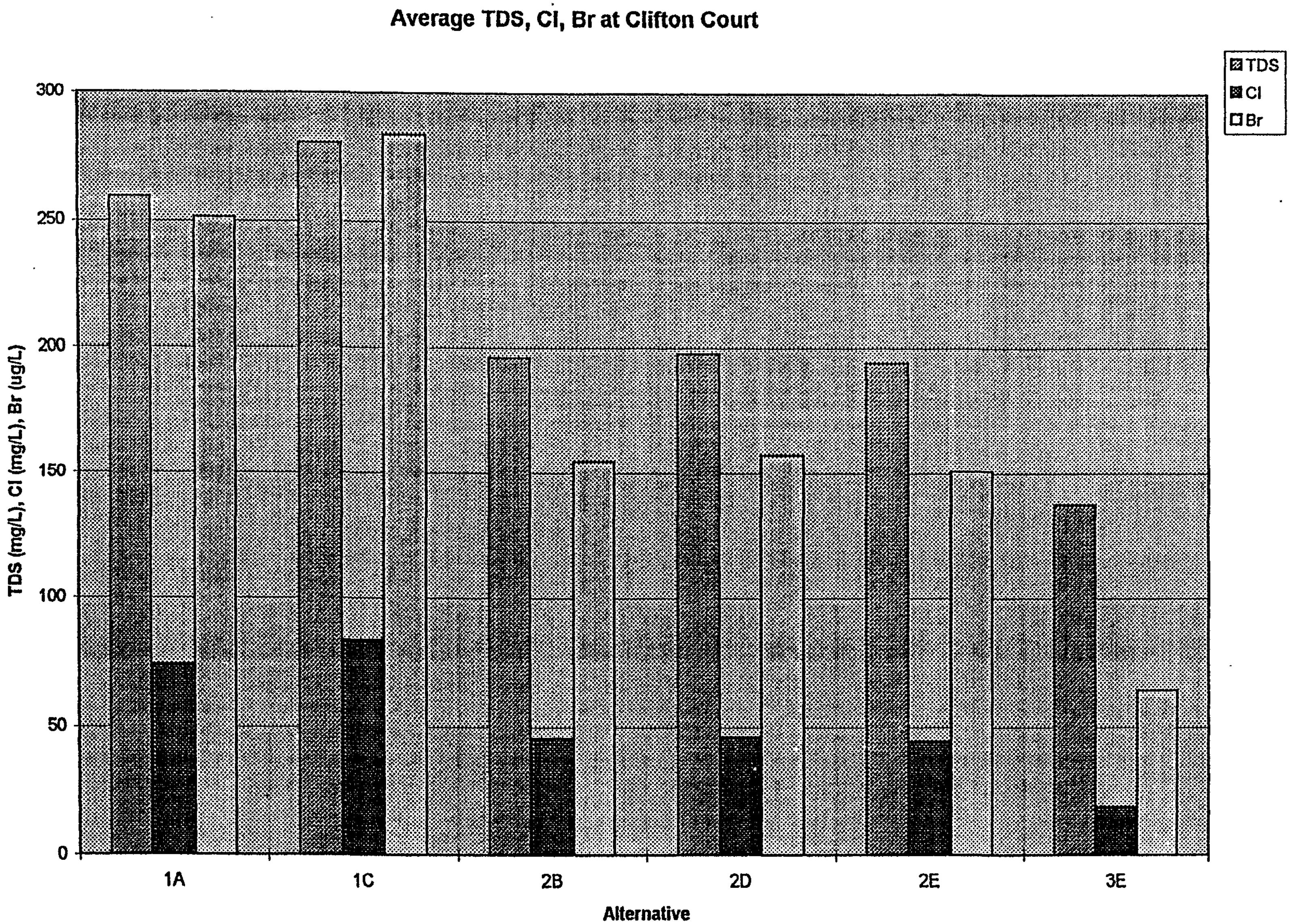
The DWR disinfection byproducts model will be used to estimate organic carbon concentrations. Lower levels of organic carbon are preferable and will be provided the highest score. Table 2.1 shows estimates of organic carbon levels.

Agricultral Water

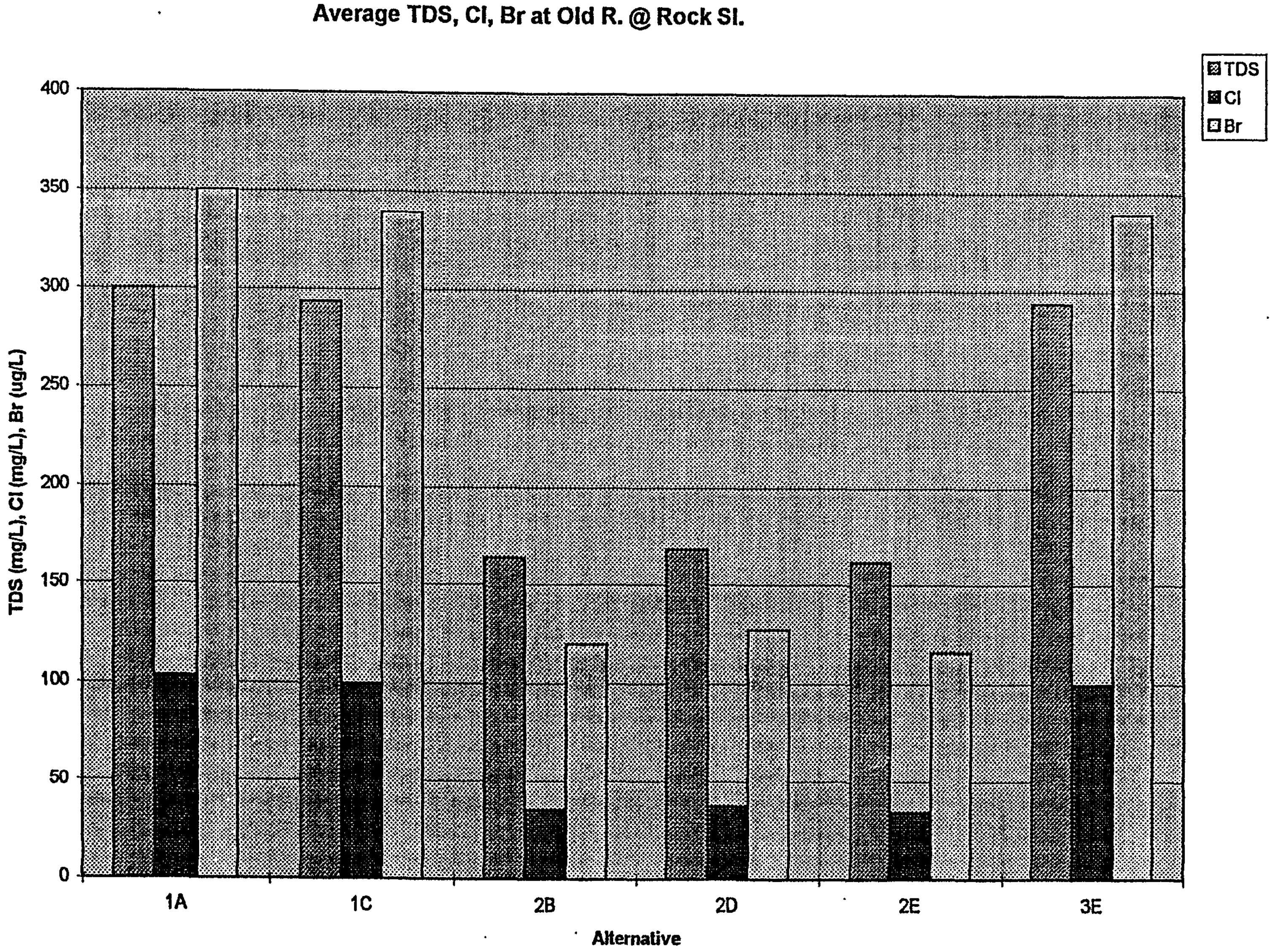
Agricultural areas that rely on surface water exported from the south-Delta will be adversely impacted from any increase in the salinity of their source water, regardless of the magnitude. This is primarily due to the increased total mass of salts that would be delivered to irrigated fields by the saltier irrigation water. To ensure that reductions in crop yields would not result from the increased salinity, more water would have to be used to provide adequate leaching. This results in greater quantities of salinity laden drainage water that would have to be discharged back to surface waters or sent to evaporation ponds or other disposal sites.

In addition, during drought periods when surface water supplies are reduced, export areas, especially along the westside of the San Joaquin Valley, rely on groundwater as a supplemental source. This groundwater tends to be much higher in salts and is historically diluted with available surface water prior to applying to fields. When the surface water salinity increases, more water would be needed to dilute the groundwater to achieve the desired irrigation water salinity level. However, if there is a limited supply of surface water and more is needed to blend, then the result is a reduction in amount of water available for irrigation (at a given quality).

Though yield impacts from higher water salinity is an issue in the export areas, the adverse impact to drainage quality and quantity and to water supply are of greater importance.

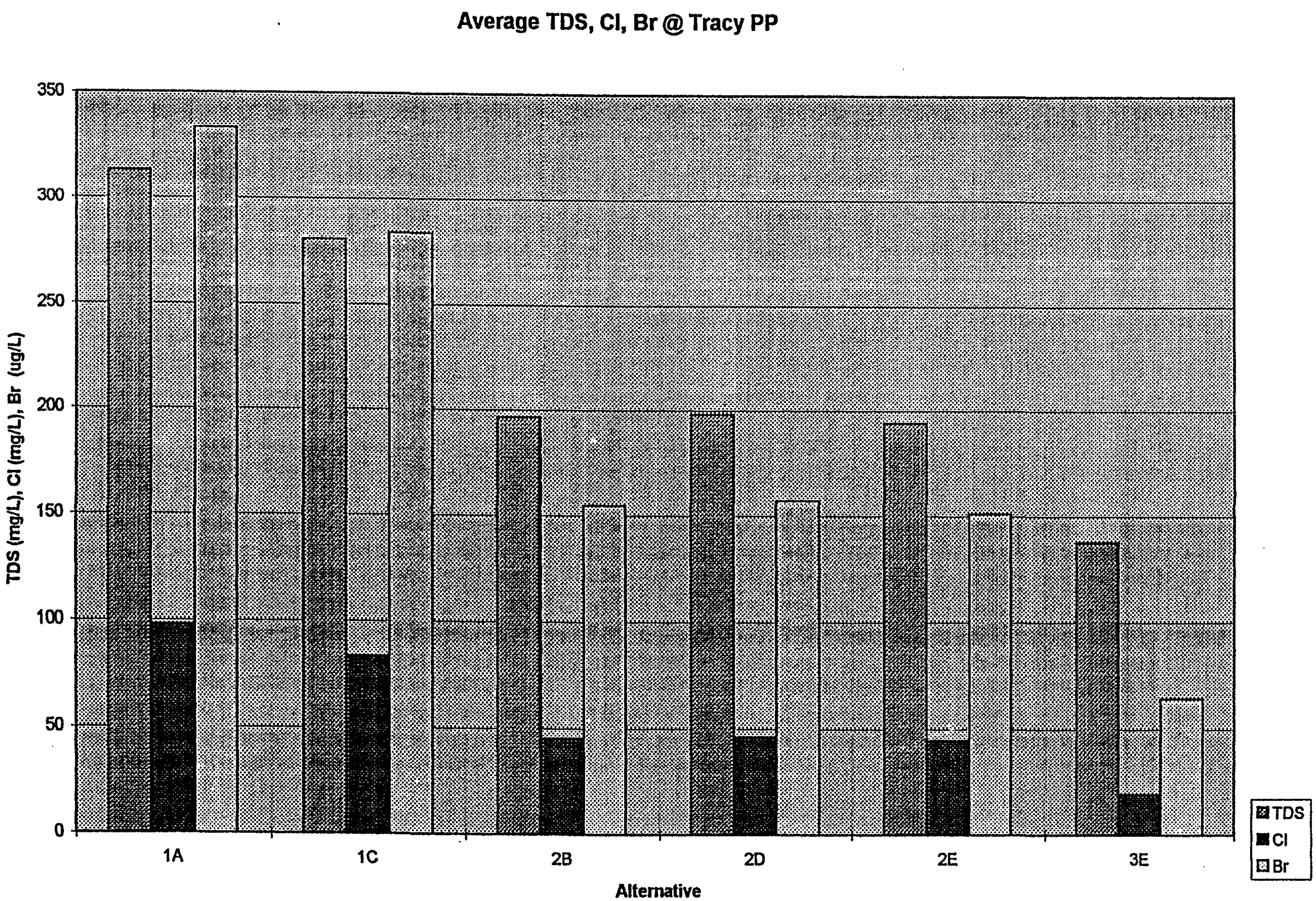

Average TDS, Cl, Br at Clifton Court
TDS
Cl
Br
300
250
200
150
100
50
0
TDS (mg/L), Cl (mg/L), Br (ug/L)
1A
1C
2B
2D
2E
3E
Alternative

E-015454



E-015455

E-015455

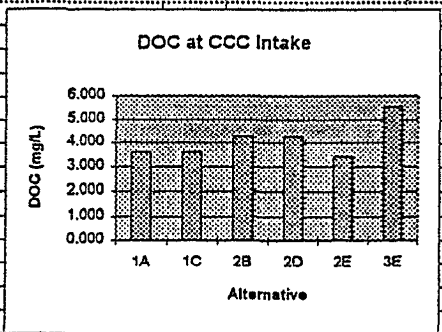

Average TDS, Cl, Br @ Tracy PP
TDS (mg/L), Cl (mg/L), Br (ug/L)
0
50
100
150
200
250
300
350
1A
1C
2B
2D
2E
3E
Alternative
TDS
Cl
Br

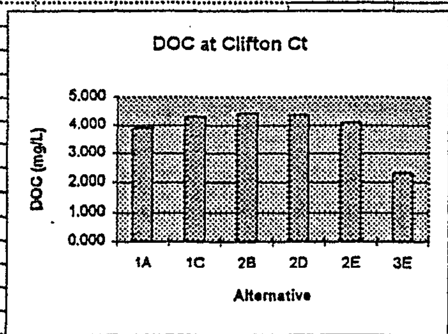
E-015456

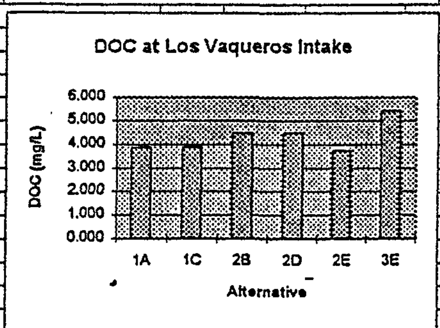
File: DOCQUER.XLS

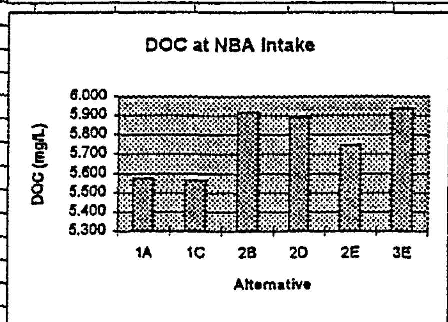
Summary of Predicted Average DOC concentrations at export locations during water years 1985, 86, and 87.

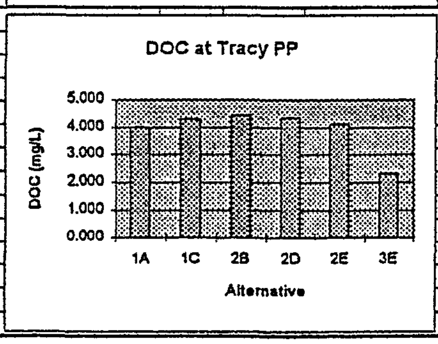
Station	Alt	Avg	Parameter	Min	Max	StDev	Count
CCC Intake	1A	3.592	DOC	2.422	7.735	0.971	36
CCC Intake	1C	3.611	DOC	2.456	7.663	0.958	36
CCC Intake	2B	4.266	DOC	3.256	7.665	0.918	36
CCC Intake	2D	4.276	DOC	3.350	7.352	0.839	36
CCC Intake	2E	3.419	DOC	2.499	7.241	0.864	36
CCC Intake	3E	5.537	DOC	4.104	9.994	1.674	36
Clft Court	1A	3.921	DOC	2.538	6.032	0.855	36
Clft Court	1C	4.316	DOC	3.199	5.843	0.617	36
Clft Court	2B	4.441	DOC	3.615	5.841	0.571	36
Clft Court	2D	4.368	DOC	3.484	5.849	0.642	36
Clft Court	2E	4.122	DOC	2.957	5.848	0.717	36
Clft Court	3E	2.325	DOC	2.006	2.715	0.160	36
Los Vaqueros Intake	1A	3.889	DOC	2.543	6.279	0.906	36
Los Vaqueros Intake	1C	3.886	DOC	2.673	6.171	0.879	36
Los Vaqueros Intake	2B	4.481	DOC	3.405	7.013	0.889	36
Los Vaqueros Intake	2D	4.520	DOC	3.526	6.525	0.845	36
Los Vaqueros Intake	2E	3.758	DOC	2.726	6.486	0.820	36
Los Vaqueros Intake	3E	5.434	DOC	4.223	7.469	0.917	36
NBA Intake	1A	5.574	DOC	3.287	13.876	2.421	36
NBA Intake	1C	5.567	DOC	3.291	13.889	2.414	36
NBA Intake	2B	5.916	DOC	3.533	13.912	2.393	36
NBA Intake	2D	5.889	DOC	3.498	13.844	2.381	36
NBA Intake	2E	5.747	DOC	3.344	13.814	2.381	36
NBA Intake	3E	5.942	DOC	3.546	13.933	2.386	36
Tracy PP	1A	4.025	DOC	3.057	6.010	0.781	36
Tracy PP	1C	4.316	DOC	3.199	5.843	0.617	36
Tracy PP	2B	4.441	DOC	3.615	5.841	0.571	36
Tracy PP	2D	4.368	DOC	3.484	5.849	0.642	36
Tracy PP	2E	4.122	DOC	2.957	5.848	0.717	36
Tracy PP	3E	2.325	DOC	2.006	2.715	0.160	36











E-015457

3.
DIVERSION EFFECTS ON FISHERIES

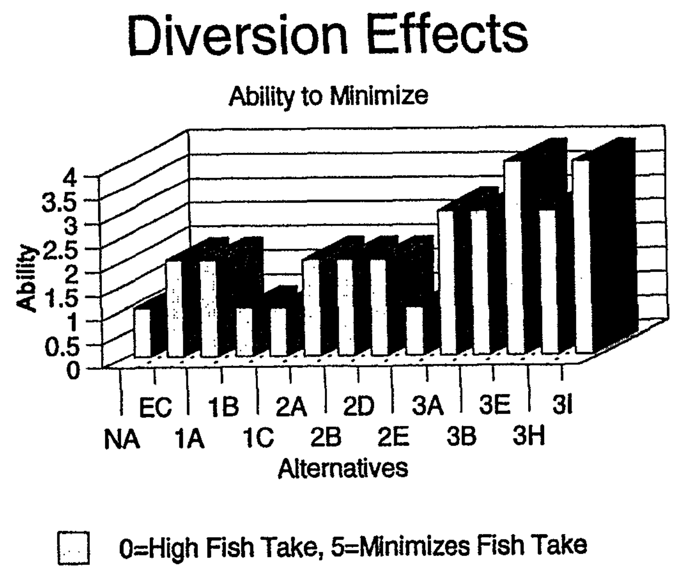
Diversion Effects on Fisheries Supporting Information

Definition

"Diversion Effects on Fisheries" are intended to include only the **direct effects on fisheries due to the export diversion intake and associated fish facilities**. These will vary depending on diversion location, size, type, method of handling bypassed fish, and annual volume of water diverted. The effects on flow patterns in the Delta as a result of the diversion are addressed in the distinguishing characteristic for "Delta Flow Circulation". The loss of fish due to diversion to another route is covered in this effect.

Summary

Alternatives that export all or the majority of the export water out of the south Delta have higher diversion effects on fisheries than alternatives that export water from the north Delta. The through-Delta alternatives with new screens and pumps on the Sacramento River partially reduce these effects by reducing movement of fish from the Sacramento River into the interior Delta, but generate additional effects (e.g. blocking upstream fish migration, handling and pump damage) that must be resolved. Storage adds a degree of operational flexibility that can be used to reduce the diversion effects by altering the export timing to periods when fish are not near the diversion intake. Alternative variations with an isolated facility have the greatest potential to reduce diversion effects because the diversion point is located away from the interior Delta and nearer the outer limit of the tidal influence where state-of-the-art screens are more effective. Isolated facilities also reduce the loss of fish into interior Delta channels from their primary migration routes, thus improving overall survival. For some species with pelagic larvae abundant in the lower Sacramento River (e.g. delta smelt and striped bass), isolated conveyance facilities increase the potential for loss from the north Delta over existing conditions, because larval fish pass through the fish screens and lost.



The chart at the right shows preliminary estimates of how well the alternatives minimize diversion effects. The alternatives that do the most to reduce diversion effects get a score of "5" and those that do the least get a score of "0".

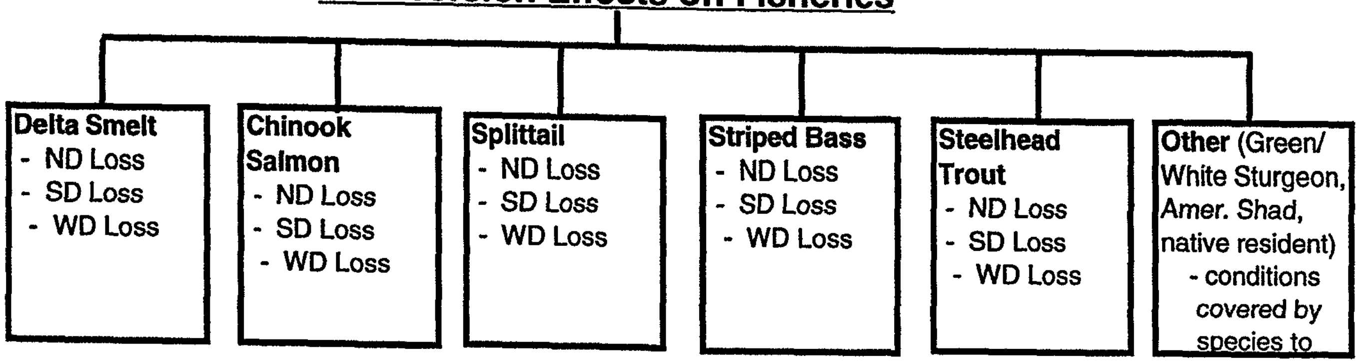
Alternative 1 variations with the existing diversion configuration have the most diversion effects. Some improvements are provided by improved fish protection facilities at the Delta pumping plants and by improved timing of diversions allowed by new storage and increased diversion capacity at the south Delta pumping plants. However, greater pumping capacity and higher potential for upstream (negative) Old and Middle River flows with improved south Delta facilities may increase losses at the south Delta pumping plants.

Alternative 2 variations have uncertain performance (0-3) with improvements provided by improved fish facilities and less fish being drawn into the interior Delta from the west (by minimizing negative net Central Delta flows), but uncertainties created by (1) Hood diversion screens blocking upstream migrant salmon, steelhead, sturgeon, shad, striped bass, delta smelt, and splittail moving through the Delta (alts 2A,B, D), (2) lack of screens to keep fish from moving into interior Delta at Hood (alt 2E), (3) Hood screens potentially damaging larval and juvenile fish during entrainment or bypass handling, and (4) higher net upstream flows in Old and Middle River from the central Delta toward the south Delta pumping plants (all alt 2s).

Alternative 3 variations also have varied performance but generally have fewer diversion effects than the alternative 2 variations. Alternative 3E and 3I have the greatest reduction in diversion effects (values of 4) from existing conditions because of fully isolated diversion facilities. Fully isolated facilities (1) eliminate south Delta diversion losses completely, (2) do not block upstream migrating fish behind screens, and (3) do not draw fish into the interior Delta. Fully isolated facilities do not reach the full potential benefit, because fish with larval stages (e.g. delta smelt and striped bass) would be lost to entrainment. Alternative with partially isolated facilities (3A, B, H) offer performance (1-3) that is intermediate between alternatives 2 and the fully isolated alternatives as they have a combination of through-Delta and isolated facilities. Alternatives 3A and 3B provide more certain benefits (2 and 3, respectively) than alternative 2, because screens do not block upstream migrants and there would not be higher upstream flows in Old and Middle River toward the south Delta pumping plants. Alternative 3H retains some of the uncertainty (3-4) of its counterpart alternative 2E, because of the unscreened opening on the Sacramento River near the head of Georgiana Slough and the unknown potential of fish retention in the expanded habitat areas downstream of the diversion point. However, having a small isolated facility provides better performance than alternative 2E, because flows into the unscreened entrance to the interior Delta would be lower and there would be lower net upstream flows in Old and Middle River toward the south Delta pumping plants.

E-015461

3. Diversion Effects on Fisheries



To Decision Matrix

Table 3.1 Summary (How Well Each Alternative Minimizes Fish Losses at Diversion)

	Delta Smelt				Chinook Salmon				Splittail				Striped Bass				Steelhead Trout				Total
Alternative	WD	SD	ND	*total*	WD	SD	ND	*total*	WD	SD	ND	*total*	WD	SD	ND	*total*	WD	SD	ND	*total*	Score
importance	2	2	1		1	1	2		1	2	2		2	2	1		1	1	2		
Exist. Cond.	0	0	2	***0***	0	0	1	***1***	1	1	2	***1***	0	1	2	***1***	0	0	1	***1***	***1***
No-action	0	1	2	***1***	0	2	2	***2***	1	2	2	***2***	1	2	2	***2***	0	2	2	***2***	***2***
1A	0	1	2	***1***	0	2	2	***2***	1	2	2	***2***	1	2	2	***2***	0	2	2	***2***	***2***
1B	0	0-1	2	***0-1***	0	1-3	2	***1-2***	1	2	2	***2***	1	1	2	***1***	0	1-2	2	***1-2***	***1-2***
1C	0	0-1	2	***0-1***	0	1-3	2	***1-2***	1	2	2	***2***	1	1	2	***1***	0	1-2	2	***1-2***	***1-2***
2A	3	0-1	1-2	***1-2***	3	1-3	3	***2-3***	3	2	1-2	***2-3***	3	1	1-2	***2***	3	1-2	3	***2-3***	***2-3***
2B	3	0-1	1-2	***1-2***	3	1-3	3	***2-3***	3	2	1-2	***2-3***	3	1	1-2	***2***	3	1-2	3	***2-3***	***2-3***
2D	3	0-1	1-2	***1-2***	3	1-3	3	***2-3***	3	2	1-2	***2-3***	3	1	1-2	***2***	3	1-2	3	***2-3***	***2-3***
2E	3	0-1	2-4	***1-2***	3	1-3	1-4	***1-3***	3	2	2-4	***2-3***	3	1	2-3	***2***	3	1-2	1-3	***1-4***	***1-3***
3A	4	3	0-1	***3***	4	3	3	***3***	4	3	2-3	***3***	4	3	0-1	***3***	4	3	3	***3***	***3***
3B	4	3	0-1	***3***	4	3	3	***3***	4	3	2-3	***3***	4	3	0-1	***3***	4	3	3	***3***	***3***
3E	5	4	0	***3***	5	5	4	***4.5***	5	5	1	***3***	5	5	0	***4***	5	5	4	***4.5***	***4***
3H	4	3	1-3	***3***	4	3	2-4	***3-4***	4	3	2-4	***3-4***	4	3	2	***3***	4	3	2-4	***3-4***	***3-4***
3I	5	4	0-1	***3***	5	5	5	***5***	5	5	1	***3***	5	5	1	***4***	5	5	5	***5***	***4***

WD = West Delta, SD = South Delta, ND = North Delta; ***importance refers to importance of the location for the species (not across species)***
Values are on a scale from 0 to 5; with 5 representing the best performance and 0 representing the worst performance.

E-015461

Supporting Information for Table 3.1

The CALFED Interagency Fish Facilities Technical Team (DWR, DFG, USBR, NMFS, USFWS, USGS, USEPA, and independent advisory panel) investigated the major fish passage facility issues and alternatives within the CALFED Bay-Delta program. The team's July 28, 1997 status report, *Fish Screening and Fish Passage Analysis of the CALFED Bay-Delta Program Phase II Delta Conveyance Alternatives*, was used here for primary information on the performance of the alternatives relating to diversion effects on fisheries. In addition the July 1997 draft environmental impacts technical report, *Fisheries and Aquatic Resources*, was used as a reference.

The diversion effects on fisheries for each alternative are rated here on a scale from 0 to 5. ("0 represents poor performance and "5" represents high performance.) The following rankings by alternative are based on qualitative assessments using available information.

Existing and No-Action Conditions **Score = 1 and 2, respectively**

Existing conditions are given a score of 1 because existing fish facilities and operational constraints to protect fish. Low performance under existing conditions from high entrainment and handling losses and poor habitat conditions are only slightly improved under the no-action through improved fish facilities and operations; thus the No-Action alternative was given a score of 2.

Alternative - 1A **Score = 2**

This alternative assumes that existing fish protective facilities will be brought up to their original design standards. Since no new facilities are proposed this alternative is basically a continuation of the status quo. Fish that are salvaged at the fish facilities must be transported for release. The existing South Delta export diversion effects on fisheries would continue to be high due to fish being drawn into the dead-end of the south Delta where they are subject to (1) poor habitat conditions and high predator concentrations, (2) entrainment into south Delta pumps, or (3) handling damage at the fish facilities. Due to these continuing effects on fisheries, alternative 1A has been given a score of 2.

Alternative - 1B **Score = 1-2**

This alternative includes an inter-tie between the SWP and CVP (Clifton Court Forebay and Tracy facilities), new state-of-the-art fish screens at the Tracy Fish Protective Facility and new state-of-the-art fish screens for Clifton Court Forebay. Screening for

Clifton Court Forebay has several design issues that must be resolved. The inter-connection provides some degree of operational flexibility between the SWP and CVP that could be used to lessen the impacts of the diversion. The new screens lessen the diversion effects on the fishery but the continued diversion from the South Delta remains a significant problem. The screens would have beneficial impacts on juvenile and adult life stages of most Delta species relative to the no-action alternative. Entrainment of egg and larval life stages of resident species, including sriped bass, delta smelt, longfin smelt and Sacramento splittail, would continue. Entrainment of planktonic invertebrates (i.e., native mysids and rotifers) would also continue. Higher potential flows upstream toward the south Delta pumping plants caused by improved south Delta conveyance facilities and Head of Old River barrier may decrease fish survival and negate some of the benefits and cause uncertainty. The addition of the Head of Old River barrier would reduce diversion losses of downstream migrating juvenile San Joaquin salmon. Alternative 1B is judged to provide less certainty for improving diversion losses than alternative 1A. Therefore, alternative 1B has been given a score of 1-2.

Alternative - 1C <u>**Score = 1-2**</u>

This alternative provides the same fish facilities as alternative 1B. The addition of surface storage for this alternative could improve operational flexibility between the SWP and CVP that could be used to slightly lessen the impacts of the diversion. The addition of flow control structures could require fish passage facilities as a site specific issue. The export diversion effects on fisheries are expected to be almost identical to alternative 1B. Therefore, alternative 1C has been given a score of 1-2.

Alternative - 2A <u>**Score = 2-3**</u>

This alternative provides the same fish facilities as alternative 1B and adds a 10,000 cfs screened through Delta diversion at Hood. The screened diversion at Hood could reduce the number of outmigrating Sacramento River fish entering the Central Delta from either the north Delta or the west Delta (by providing a higher net Central Delta outflow). However, fish concentrated in the remaining Sacramento River flow could continue to move into the Central Delta through the unscreened Georgiana Slough. Flows into Georgiana Slough would reduce somewhat with the new diversion at Hood. Depending on the change in movement into Georgiana Slough, Alternative 2A may provide slight beneficial impacts for outmigrating Sacramento River fish which would lessen the diversion effects at the South Delta export facilities from those in alternative 1B. The new screen at Hood could produce a substantial adverse impact on upstream migrating fish by blocking or hindering movement from the Delta into the lower Sacramento River. Salmon and steelhead would be less effected as they would be able to negotiate the planned fish ladder; however, striped bass, delta smelt, splittail, sturgeon, and American shad would not be able to pass through the ladder. The screens would have to be lifted periodically to pass these blocked fish, but some delay or blocked migration would be likely. Also the new screen, pumps, and fish handling facilities would increase the potential losses to more delicate larval and juvenile fish that would otherwise under existing conditions not be subjected to such facilities. Though many larvae will likely survive the entrainment process at the new Hood facility and benefit from improved habitats downstream(from setback levees), some will be damaged by the process. These combined benefits and potential detrimental effects in combination with the uncertainties of increased negative flows in Old and Middle River provide only a slight overall benefit (score of 2-3) from the No-Action and alternative 1 variations.

Alternative - 2B <u>**Score =2-3**</u>

This alternative provides the same fish facilities as alternative 2A. The addition of surface storage for this alternative could improve operational flexibility between the SWP and CVP that could be used to lessen the impacts of the diversion. The addition of flow control structures could require fish passage facilities as a site specific issue. The export diversion effects on fisheries are expected to be almost identical to alternative 2A but the storage allows more flexibility to cease diversions at critical fish times. Despite this potential improvement the overall performance and uncertainties related to Alternative 2B are similar to Alternative 2A, thus the performance score is assessed at 2-3.

Alternative - 2D <u>**Score = 2-3**</u>

This alternative provides nearly the same benefits, effects, and uncertainties as alternatives 2A and 2B. The creation of large amounts of "shallow water aquatic habitat" along the migratory corridors leading to and from the Mokelumne River could improve survival of those larvae fish entrained from the Sacramento River at Hood as compared to variations of Alternative 1 and Alternative 2A and 2B. Like Alternative 2A and 2B, Alternative 2Ds screen system could block or detain migrating fish from moving into the lower Sacramento River from the Delta. Therefore, alternative 2D has been given a score of 2-3.

Alternative - 2E <u>**Score = 1-3**</u>

Though south Delta facilities are similar to other variations of alternatives 1 and 2, unlike other variations of alternative 2, Alternative 2E does not have a Hood diversion facility, and instead diverts water through an opening near the head of Georgiana Slough. Though this reduces the handling, screen, and pump damage potential, as well as potential blockage of upstream migrating fish by the screen, lack of a screen invokes substantial uncertainty as to the fate of downstream migrating juvenile salmon and steelhead. Under this alternative fish diverted from the river would hopefully survive and thrive in the expanded

Mokelumne River corridor and be able to move west with the more positive net Central Delta outflows (to the west rather than south). Considerable differences in professional opinion remain on how sucessful or detrimental the corridor may be to fish. Analytical methods sufficient to answer the question on how well this performs are not available during the time frame of the programmatic EIR/EIS. Due to the uncertainties that can only be answered by years of study and perhaps only by large scale pilot studies, the performance of this alternative cannot be accurately rated with certainty at this time. Therefore, alternative 2E has been given a score of 1-3 to reflect this uncertainty, as well as the potential beneficial or detrimental consequences.

Alternative - 3A **Score = 3**

This alternative provides the same fish facilities as alternative 1B but adds a screened diversion at Hood and a 5,000 cfs isolated conveyance facility to the South Delta export facilities. The isolated facility will reduce entrainment for the majority of in-Delta fish by substituting north Delta diversion for south Delta diversion. Reducing cross Delta flows will be incrementally benefical for Sacramento River and Delta fish, by reducing fish drawn into the south Delta. Fish species that spawn and rear in the central and south Delta, including delta smelt, striped bass, and Sacramento splittail, will benefit. However, continuing reliance on the South Delta fish facilites to collect and haul fish away from a dead end area continues to be a compromise to the system. Up to 10,000 cfs would continue to be diverted through the South Delta export facilities. The two new north Delta diversion facilities would substantially reduce the loss of salmon and steelhead, and larger juveniles of delta smelt and splittail to the interior Delta from the Sacramento River. However, smaller striped bass, delta smelt, and splittail would be subjected to entrainment loss or damage from screens and pumps, as well as fish, depending on the level of mortality associated with the Hood screen and on any change in movement of fish into Georgiana Slough.

Entrainment of egg and larval life stages cannot be effectively screened and losses relative to the no-action alternative may be increased in the north Delta but with a decrease from the south Delta. Egg and larval striped bass, American shad, delta smelt, and splittail transported down the Sacramento River would be affected to the greatest degree. Entrainment, however, may be reduced by stopping diversion into the isolated facility during periods of egg and larval occurrence.

This alternative provides overall lower fish entrainment over the no-action alternative and the alternative 1 variations that continue all exports from the South Delta but South Delta export impacts remain relatively high. Therefore, alternative 3A has been given a score of 3. Replacing the open channel isolated facility with a pipeline should score the same.

E-015466

Alternative - 3B **Score = 3**

This alternative provides the same fish facilities as alternative 3A. The addition of surface storage for this alternative could improve operational flexibility between the SWP and CVP that could be used to slightly lessen the impacts of the diversion. Alternative 3B has been given a score of 3. Replacing the open channel isolated facility with a pipeline should score the same.

Alternative - 3E **Score = 4**

This alternative is the same as alternative 3B with a 15,000 cfs isolated facility rather than a 5,000 cfs facility. As envisioned, the majority of diversions would take place through the screened intake at Hood. This would screen the majority of water at an optimum location, and would eliminate adult migration straying concerns. This alternative is the least risky from a fish facility operational and performance point of view. All bypassed fish would be returned to the Sacramento River substantially reducing the need to salvage and haul fish from the South Delta export facilities; however, entrainment losses of egg and larval delta smelt, striped bass, splittail, sturgeon, and American shad would occur at the Hood diversion facility. Losses from damage at the fish screen and bypass facility would be expected for salmon, steelhead, striped bass, delta smelt, splittail, sturgeon, American shad, and other native and non-native fish species. For this reason Alternative 3E has been given a score of 4 out of 5.

Alternative - 3H **Score = 3-4**

This alternative is the same as Alternative 3B plus a through Delta conveyance/habitat corridor similar to alternative 2E. This alternative assumes Sacramento River water can be diverted into a Central Delta conveyance/habitat corridor without fish screens. The alternative assumes that fish diverted from the river will survive and thrive in the expanded corridor. Considerable differences in professional opinion remain on how sucessful or detrimental the corridor may be to fish. Analytical methods sufficient to answer the question on how well this performs are not available during the time frame of the programmatic EIR/EIS. Due to the uncertainties that can only be answered by years of study and perhaps only by large scale pilot studies, the performance of this alternative cannot be accurately rated high at this time. Despite this uncertainty compared to Alternative 2E, Alternative 3H provides additional protection with an isolated fish facility, thus reducing south Delta losses. Compared to Alternative 3A and 3B, Alternative 3H does not block upstream migrating fish at fish screens at Hood. The substantial habitat area provided in the north Delta below the diversion also potentially offers greater survival to fish entrained at the diversion. For these reasons Alternative 3H was given a score of 3-4. Replacing the open channel isolated facility with a pipeline should score the same.

E-015466

Alternative - 3I **Score = 4**

This alternative is the same as alternative 3E plus facilities for 3 additional in-Delta diversions. The operational considerations and hydraulic impacts of this alternative will be very complex. Because the goal is flexibility, it may be necessary to screen each of the three central Delta inakes for a full diversion to avoid excessive predation and losses of San Joaquin and Delta fish. Such facilities would be difficult to hydraulically regulate with or without screens. Although this may be an costly alternative, it does offer slightly added protection compared to Alternative 3E if it can be monitored and controlled. The central Delta screens would likely require salvage and hauling of fish. The diversion on the Sacramento River at Hood would likely operate most of the time. The performance of this alternative would be almost identical to that of alternative 3E with some added operational flexibility from the multiple intakes. Therefore, alternative 3I has been given a score of 4.

4.
DELTA FLOW CIRCULATION

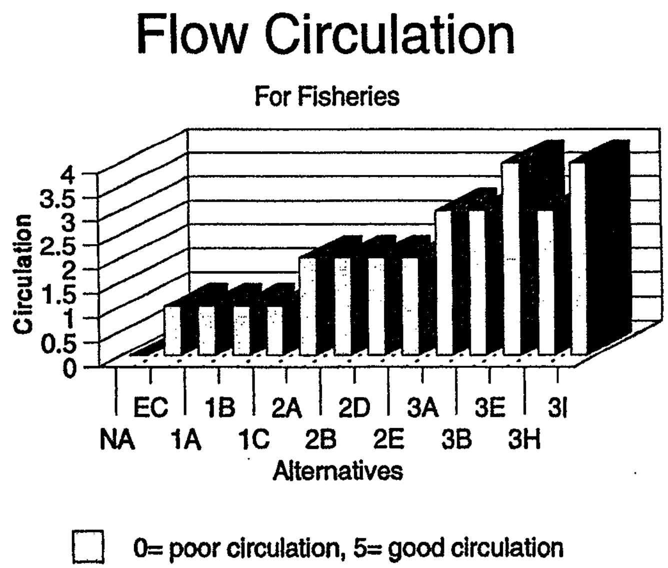
Delta Flow Circulation Supporting Information

The Delta Simulation Model results show Delta circulation (flow patterns) which affect movement (transport) of fish. A relative qualitative assessment will provide the highest rank to the alternatives with the best flow circulation for fish. These include a good net outflow from the San Joaquin River with minimization of reverse flow. Reducing the amount of San Joaquin River water that is recirculated through the export pumps would increase the amount of San Joaquin water getting into the Central Delta and eventually into the western Delta benefits fish habitat through greater productivity of these waters. Minimization of cross Delta flows would also benefit flow circulation for fisheries.

Definition

"Delta Flow Circulation" is intended to include the **direct and indirect effects of water flow circulation on fisheries due to the export diversions and changes in cross-Delta water conveyance facilities.** These will vary depending on diversion location, size, type, and operation of conveyance facilities, and annual volume of water diverted.

Summary



Alternatives that export all or the majority of the export water out of the south Delta will cause unnatural flow patterns in the south Delta (negative Old and Middle River flows), north Delta (greater southerly flows in the Mokelumne channels), and west Delta (lower and more negative net Central Delta flows in lower San Joaquin channel between Antioch and Old River). These unnatural patterns are detrimental to fish by altering migration ques and diminishing the productivity of habitats. Alternatives that export all water from the North Delta through isolated facilities would allow natural flow patterns in the Delta, but would continue to export freshwater and nutrients that contribute to habitat value, but at a lessor rate than existing conditions. Alternative that divert a portion of the water from the North Delta would provide intermediate effects from the two described above. Increasing the flow across the Delta via new facilities near Hood would increase flow into the interior Delta and corresponding decrease flow in the lower Sacramento River below the diversion and in Sutter and Steamboat sloughs as well. Such changes may increase downstream migration deflection from the Sacramento River into the Delta, and reduce habitat quality further in the interior Delta through lowering residence time of water. Increased capacity of south Delta channels along with greater pumping capacity at south Delta pumps would cause greater than existing flows in Old and Middle River upstream toward the south Delta pumping plants, which would reduce habitat values and alter migration cues further than under existing conditions. A barrier at the head of Old River allows most San Joaquin water to move down the San Joaquin channel rather than flow toward the south Delta pumping plants via the Old River and adjacent channels in the south Delta. Increasing the amount of San Joaquin water getting into the Central Delta and eventually into the western Delta benefits fish habitat through greater productivity of these waters. Alternative that add habitat area through setbacks and open conveyance systems provide additional migratory, spawning, and rearing habitat, as well as more potential overall biological productivity, which together should benefit fish populations in general. Storage adds a degree of operational flexibility that can be used to adjust seasonal flow differences.

<u>Alternative 1</u> variations with the existing diversion configuration change circulation in the Delta little from existing conditions. Some improvements are provided by improved fish protection facilities at the Delta pumping plants and by improved timing of diversions allowed by new storage and increased diversion capacity at the south Delta pumping plants. However, greater pumping capacity and higher potential for upstream (negative) Old and Middle River flows with improved south Delta facilities may reduce the habitat value of the central and south Delta.

<u>Alternative 2</u> variations offer improvement in central and western Delta habitat and migration by providing positive net Central Delta outflow substantially improved over alternative 1 variations and existing conditions. Higher cross-Delta flows however reduce habitat value and migration problems in the north and southern Delta. Greater cross-Delta flows in combination with the barrier at the head of Old River allow greater amounts of San Joaquin water to reach the central and western Delta, which would benefit fish habitat and improve migration of San Joaquin fish through the Delta. Substantial increases in habitat provided in alternative 2B, 2C, and 2E should provide reduced detrimental flows in the Mokelumne and south Delta channels.

<u>Alternative 3</u> variations offer substantial improvements in fish habitat and migration by restoring greater degrees of natural circulation to the Delta. More positive net Central Delta outflow, reduced cross-Delta flows from the north through the south Delta, positive Old and Middle River downstream flows, and greatly reduced diversion of San Joaquin water provide greatly improved fish habitat and migration. Alternative 3E and 3I have the greatest potential improvement with fully isolated facilities. Fully isolated facilities (1) eliminate cross-Delta flows completely, (2) virtually eliminate export of San Joaquin water, and (3) provide positive net Central Delta outflow to the greatest extent. They fail to reach the full potential because they continue to export water from the north Delta, which reduces potential freshwater and nutrient input to the Delta and Bay, and reduces

migratory transport and ques along the lower Sacramento River, and Sutter and Steamboat sloughs. Alternative with partially isolated facilities (3A, B, H) offer performance (1-3) that is intermediate between alternatives 2 and the fully isolated alternatives as they have a combination of through-Delta and isolated facilities. Alternatives 3H retain like its counterpart alternative 2E, provides large areas of additional habitat and higher residence times that would benefit production and migration for many species.

The above chart shows preliminary estimates of Delta flow circulation (to benefit fisheries transport) for the alternatives. The most desirable circulation in the chart and Table 4.1 is given a score of "5" and the least desirable circulation is given a score of "0".

E-015471

E-015472

4. Delta Flow Circulation

- **Delta Smelt**
  - Net SJ
  - SJ Water
  - XD Flow
- **Chinook Salmon**
  - Net SJ
  - SJ Water
  - XD Flow
- **Splittail**
  - Net SJ
  - SJ Water
  - XD Flow
- **Striped Bass**
  - Net SJ
  - SJ Water
  - XD Flow
- **Steelhead Trout**
  - Net SJ
  - SJ Water
  - XD Flow
- **Other** (Green/ White Sturgeon, Amer. Shad, native resident)
  - Net SJ
  - SJ Water
  - XD Flow

To Decision Matrix

Table 4.1 Summary

Alternative	Delta Smelt			Chinook Salmon			Splittail			Striped Bass			Steelhead Trout			Other			Overall Score
	Net SJ	XD	SJ	Net SJ	XD	SJ	Net SJ	XD	SJ	Net SJ	XD	SJ	Net SJ	XD	SJ	Net SJ	XD	SJ	
Exist. Cond.	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	**0**
No-action	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	**1**
1A	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	**1**
1B	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	**1**
1C	1	1	1	1	1	2	1	1	2	1	1	1	1	1	2	1	1	2	**1**
2A	3	0	2	3	0	3	3	0	3	3	0	2	3	0	3	3	0	3	**2**
2B	3	1	2	3	1	3	3	1	3	3	1	2	3	1	3	3	1	3	**2**
2D	3	1	2	3	1	3	3	1	3	3	1	2	3	1	3	3	1	3	**2**
2E	3	2	2	3	2	3	3	2	3	3	2	2	3	2	3	3	2	3	**2-3**
3A	4	2	3	4	2	3	4	2	3	4	2	3	4	2	3	4	2	3	**3**
3B	4	2	3	4	2	3	4	2	3	4	2	3	4	2	3	4	2	3	**3**
3E	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	**4**
3H	4	2-4	3	4	2-4	3	4	2-4	3	4	2-4	3	4	2-4	3	4	2-4	3	**3-4**
3I	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	**4**

Values are on a scale from 0 to 5; with 5 representing the best performance and 0 representing the worst performance.

E—015472

E-015473

Supporting Information for Table 4.1

The July 1997 draft environmental impacts technical report, *Fisheries and Aquatic Resources*, was used as a reference.

The circulation effects on fisheries for each alternative are rated here on a scale from 0 to 5. ("0 represents poor performance and "5" represents high performance.) The following rankings by alternative are based on qualitative assessments using available information.

Existing and No-Action Conditions **Score = 0 and 1, respectively**

Existing circulation conditions are given a score of 0 because existing habitat and migration conditions are poor. Low performance under existing conditions from poor habitat and migrating conditions are only slightly improved under the no-action through improved project operations; thus the No-Action alternative was given a score of 1.

Alternative - 1A **Score = 1**

This alternative alters circulation little compared to the No-Action alternative; thus it is given a score of 1.

Alternative - 1B **Score = 1**

This alternative alters circulation little compared to the No-Action alternative; thus it is given a score of 1.

Alternative - 1C **Score = 1**

The addition of surface storage for this alternative could improve operational flexibility between the SWP and CVP that could be used to slightly improve circulation. The Barrier at Head of Old River would also slightly improve habitat quality and migration cues from the San Joaquin River. Overall improvements would be minor when compared to alternatives 1A and 1B; therefore the score is 1.

E-015473

E-015474

Alternative - 2A **Score = 2**

This alternative provides substantial improvement in net Central Delta outflow and the amount of San Joaquin water reaching the Delta; however higher cross-Delta flows are detrimental to habitat and migration of fish. [It should be recognized that net Central Delta outflow is just an indicator, and that the magnitude of tidal excursion will overpower this for significant periods.] On balance there is some improvement over alternative 1 variations to provide a score of 2.

Alternative - 2B **Score = 2**

This alternative provides the similar habitat and migration conditions as Alternative 2A. The addition of surface storage for this alternative could improve operational flexibility between the SWP and CVP that could be used to slightly improve circulation to benefit fish. Habitat improvements (setbacks) in the Delta would also benefit. These benefits would not sufficiently increase the score above 2.

Alternative - 2D **Score = 2**

This alternative provides nearly the same benefits, effects, and uncertainties as alternatives 2A and 2B; thus it received a score of 2.

Alternative - 2E **Score = 2-3**

Though facilities are similar to other variations of alternatives 1 and 2, unlike other variations of alternative 2, Alternative 2E does not have a Hood diversion facility, and instead diverts water through an opening near the head of Georgiana Slough. Though this also contributes to poor Delta circulation, the substantial new habitat and lack of new Hood diversion may provide uncertain additional habitat and circulation benefits that would not occur with previous alternatives, thus a score of 2-3 was given.

Alternative - 3A **Score = 3**

This alternative provides the same fish facilities as alternative 1B but adds a screened diversion at Hood and a 5,000 cfs isolated conveyance facility to the South Delta export facilities. The isolated facility will reduce poor circulation and habitat conditions in the Delta; thus a score of 3 was given.

E-015474

E-015475

Alternative - 3B <u>**Score = 3**</u>

This alternative provides the same fish facilities as alternative 3A. The addition of surface storage for this alternative could improve operational flexibility between the SWP and CVP that could be used to slightly lessen the impacts of the diversion. Alternative 3B has been given a score of 3. Replacing the open channel isolated facility with a pipeline should score the same.

Alternative - 3E <u>**Score = 4**</u>

This alternative is the same as alternative 3B with a 15,000 cfs isolated facility rather than a 5,000 cfs facility. As envisioned, the majority of diversions would take place through the screened intake at Hood. This would screen the majority of water at an optimum location, and would eliminate most of the unnatural circulation patterns in the Delta and improve habitat greatly. Continued diversion of freshwater and nutrients from Hood keep this alternative from scoring a 5, thus a score of 4 was given.

Alternative - 3H <u>**Score = 3-4**</u>

This alternative is the same as Alternative 3B plus a through Delta conveyance/habitat corridor similar to alternative 2E. This alternative assumes Sacramento River water can be diverted into a Central Delta conveyance/habitat corridor with potentially mixed effects. Uncertainty as to the potential benefits of the greatly expanded habitat provides a score of 3-4.

Alternative - 3I <u>**Score = 4**</u>

This alternative is the same as alternative 3E plus facilities for 3 additional in-Delta diversions. The operational considerations and hydraulic impacts of this alternative will be very complex, but are assumed to be similar to Alternative 3E; thus a score of 4 was given.

E—015475

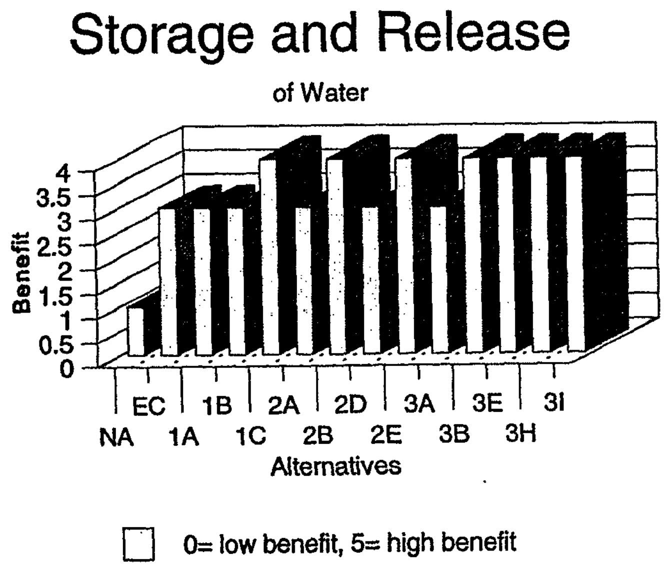
5.
STORAGE AND RELEASE OF WATER

Storage and Release of Water
Supporting Information

Water stored and released from reservoirs may provide some indirect fisheries/habitat benefits or adverse impacts. Model runs of system operations provide a coarse measure of expected instream flows and how they change by alternative. The timing of instream flwos and the degree of these changes will determine the extent to which fisheries or habitats will benefit or incur adverse impacts. Consideration of changes flows (e.g. Sacramento and San Joaquin River flows) to transport fish to the Detla will be considered. A relative qualitative score will consider the benefits of a full range of flows from dry/critical periods flows to flood flows.

Definition

"Storage and Release of Water" provides a measure of the environmental benefit or adverse effects of storing water in a new Program storage facilities and releasing that water at a later time of need. Storing the water will generally result in some degradation of environmental conditions and releasing that water, for whatever use, will generally result in some environmental benefits.



Summary

Storage of water in Program facilities will take place during the winter periods of high river flows when adverse effects on the environment are at a minimum. Release of the water for environmental uses will take place when they provide the most benefit. Release of water for other uses will generally take place during lower flow periods when the additional flows can provide some indirect benefits to instream flows. The amount of water stored and released through Program storage facilities is relatively small compared with other ongoing flows so the overall effects of the storage and release is very similar between the alternatives. Alternatives with storage will provide some marginal benefit over those without storage.

The above chart shows preliminary estimates of relative benefits from storage and release of water. The highest benefits in the chart and Table 5.1 are given a score of "5" and the lowest are given a score of "0".

E-015478

5. Storage and Release of Water

- **Delta Smelt**
  - Habitat
  - Transport
  - Entrainment
- **Chinook Salmon**
  - Habitat
  - Transport
  - Entrainment
- **Splittail**
  - Habitat
  - Transport
  - Entrainment
- **Striped Bass**
  - Habitat
  - Transport
  - Entrainment
- **Steelhead Trout**
  - Habitat
  - Transport
  - Entrainment
- **Other** (Green/ White Sturgeon, Amer. Shad, native resident)
  - Habitat
  - Transport
  - Entrainment

To Decision Matrix

Table 5.1 Summary

Alternative	Delta Smelt	Chinook Salmon	Splittail	Striped Bass	Steelhead Trout	Other	Overall Score
Exist. Cond.							1
No-action							3
1A							3
1B							3
1C							4
2A							3
2B							4
2D							3
2E							4
3A							3
3B							4
3E							4
3H							4
3I							4

All alternatives provide similar benefits since ERPP flows are the same between all alternatives and other instream flows only marginally change. Alternatives with storage provide some additional control over the timing of flows and marginally better conditions.

Values are on a scale from 0 to 5; with 5 representing the best performance and 0 representing the worst performance.

E-015478

Supporting Information for Table 5.1

See above summary.

6.
WATER SUPPLY OPPORTUNITIES

Water Supply Opportunities
Supporting Information

Water supply opportunities vary among alternatives. Modeling runs of system operations (DWR Simulation Model) provide estimates of the water supply opportunities for each alternative. Relative comparisons of the increase, or decrease, in water supply opportunities will be used to compare the alternatives.

Definition

"Water Supply Opportunities" is a measure of the change provided by the alternatives for water supply for the environment and for ag./urban uses.

Summary

The amount of water provided by the Program alternatives depends directly on the size and configuration of the storage and conveyance facilities. The charts at the right provide a summary of the Program water made available for environmental uses and for agricultural/urban uses for a critically dry year.

Model runs to determine the water supply opportunities are in progress and no preliminary estimates are available for review.

The charts will show preliminary estimates of the amount of Program water supply opportunities for the alternatives. Since higher opportunities are the most desirable, Table 6.1 provides a score of "5" to the greatest water supply opportunities and a score of "0" to the lowest impacts.

E-015481

E-015482

6. Water Supply Opportunities (new water generated from alternatives)

CALFED environmental water supply benefits (acre-feet);
- avg. year water supply
- critical year water supply

CALFED agricultural/Urban water supply benefits (acre-feet)
- avg. year water supply
- critical year water supply

To Decision Matrix

Assumes 1/3 of developed supply allocated to environmental uses and 2/3 to ag./urban uses.
Water acquired from willing sellers for ecosystem needs is accounted for separately.
No regional breakdown is available at this time.

Table 6.1 Summary

	Envir. Water Benefits				Ag./Urban Water Benefits				$/AF developed	Ag./Urb.	Envir.
Alternative	Crit. Yr. (TAF)	Score	Avg. Yr. (TAF)	Score	Crit. Yr. (TAF)	Score	Avg. Yr. (TAF)	Score	(for reference only)	Score	Score
Exist. Cond.										0	4
No-action										1	2
1A										1	2
1B										1	2
1C										3	3
2A										2	3
2B										3	3
2D										2	3
2E										3	3
3A										2	3
3B										4	4
3E										4	4
3H										4	4
3I										4	4

Data is not yet available to complete the table; Modeling work in support of this table is continuing. The scores at the right are provided as **place holders** until more detailed numbers can be developed.

Estimated costs for developed water have not yet been developed.

- For reference; - Avg. Yr. no-action water supply approximately 6.2 million acre-feet
  - Critical Yr. no-action water supply approximately 4.3 million acre-feet

Values are on a scale from 0 to 5; with 0 representing the least opportunty and 5 representing the most.

E—015482

7.
WATER TRANSFER OPPORTUNITIES

Water Transfer Opportunities
Supporting Information

Water transfer opportunities will be influenced by the transport capacity through the Delta conveyance and export facilities and the overall changes in the water transfer market. Modeling runs will be used to estimate the physical capacity (upper limit) of the export facilities available to transport water and the available capacity below the institutional constraints. These capacities will be compared to estimates of the amount of water that the market may be willing to transfer. Relative comparisons of the increase, or decrease, in transferable water will be used to evaluate the alternatives.

Definition

"Water Transfer Opportunities" is an estimate of how well each alternative can carry water that may be generated through market sales or trades at different locations in the system.

Summary

Preliminary evaluations indicate that each alternative has approximately 2,000,000 acre-feet or more of available export transport capacity in all year types. This capacity is approximately 600,000 acre-feet in the April through September period. The ability of alternatives to move transfer water above this value is a function of Delta salinity conditions and the value of key Delta standards. This identified capacity of each alternative can increase as a result of additional modeling. Preliminary estimates of the market willingness to transfer water may be only in the 100,000 to 200,000 acre-foot range. Since each alternative has capacity greatly exceeding the market need for transfers, all alternatives have the same high water transfer opportunities. Other estimates indicate the demand for transfers may exceed 600,000 to 1,000,000 acre-feet annually; in which case the scoring of alternatives may change.

Table 7.1 shows that each alternative offers high (5) transfer opportunities. However, modeling is in progress which will likely demonstrate transfer differences between alternatives.

Supporting Information for Table 7.1

See summary above.

E-015484

E-015485

7. Water Transfer Opportunities

Available Delta Conveyance/Export Capacity
- avg. year capacity (AF)
- dry year capacity (AF)

Market Interest
market interest vs. $/AF from sensitivity analysis:
- avg. year capacity (AF)
- dry year capacity (AF)

Provide available capacity under regulatory and physical constraints.

To Decision Matrix

Table 7.1 Summary

Alternative	Available Conveyance/Export Capacity								Market Interest		Overall Score
	Crit. Yr. (TAF)				Above Norm. Yr. (TAF)				Crit. Yr. (TAF)	Avg. Yr. (TAF)	
	Below Institutional Constraints		Max. Physical Capacity		Below Institutional Constraints		Max. Physical Capacity				
	Apr-Sep	Oct-Mar	Apr-Sep	Oct-Mar	Apr-Sep	Oct-Mar	Apr-Sep	Oct-Mar			
Exist. Cond.	1,648	949	4,159	2,844	581	1,317	2,473	2,054			5
No-action	1,634	1,817	4,178	2,803	581	1,416	2,245	1,699			5
1A											5
1B	1,634	1,817	4,207	2,669	581	1,416	2,299	1,492			5
1C											5
2A											5
2B	1,644	1,817	3,607	2,512	581	1,416	2,350	955			5
2D											5
2E											5
3A											5
3B											5
3E											5
3H											5
3I											5

The above select estimates of capacity indicate that ability to move the water equals or exceeds 580,000 acre-feet for the range of alternatives. The ability of alternatives to move transfer water above this value is a function of Delta salinity conditions and the value of key Delta standards

Preliminary economic estimates indicate that market interest may be in the 100,000 to 200,000 acre-feet range, well below the capacity to move the water. Some estimates indicate the demand for transfers may exceed 600,000 to 1,000,000 acre-feet annually; in which case the scoring of alternatives may change.

Values are on a scale from 0 to 5; with 0 representing the least opportunty and 5 representing the most.

E-015485

8.
OPERATIONAL FLEXIBILITY

Operational Flexibility
Supporting Information

System operational flexibility may varies by alternative. A relative qualitative scoring will depend on the diversion location(s), the flexibility in diversion timing provided by storage, multiple water diversion intakes, and other features of the alternative. The qualitative assessment provides the highest score to the alternatives with the most flexibility for water supply operations.

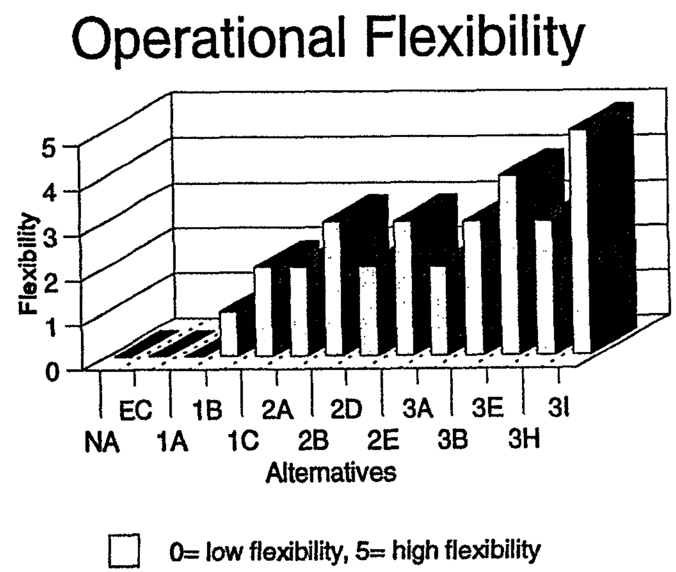
Definition

"Operational Flexibility" provides an indication of how well each alternative can shift operations as needed from time to time to provide the greatest benefits to the ecosystem, water quality, and water supply reliability.

Summary

Water storage is the one greatest feature that adds to an alternative's operational flexibility. Storage allows shifting diversion timing to respond to real time needs of the ecosystem, water quality, and water supply. Delta conveyance improvements also increase flexibility. The alternatives with the most facilities generally provide the most flexibility to respond to real-time needs. Therefore, the alternative 2 variations generally perform better than the alternative 1 variations, and the alternative 3 variations generally perform better than alternative 2 variations.

The chart at right and Table 8.1 show a measure of operational flexibility for each alternative. A score of 0 indicates little or no flexibility and a score of 5 shows a high level of operational flexibility.



Supporting Information for Table 8.1

See summary above.

E-015488

8. Operational Flexibility

Available facilities (consider flexibility provided by:)
- South Delta export capacity
- Upstream storage (AF)
- Aqueduct storage (AF)
- Isolated facility (cfs)
- In-Delta storage (AF)
- Alternate diversion points
- Groundwater storage

Ability to "Make-up " water
- ability for "make-up" water supply for various assumed protective actions (based on DWRSIM sensitivity analyses)
- avg. year capacity (AF)
- dry year capacity (AF)

To Decision Matrix

Table 8.1 Summary

Alternative	Available facilities	Ability to "make-up" water		Overall
		Crit. Yr. (TAF)	Avg. Yr. (TAF)	Score
Exist. Cond.	None			0
No-action	None			0
1A	None			0
1B	SWP/CVP intertie			1
1C	Intertie and surface storage			2
2A	Intertie & conveyance			2
2B	Intertie, thru Delta conveyance, storage			3
2D	Intertie, thru Delta conveyance, d/s storage			2
2E	Intertie, conveyance, storage			3
3A	Intertie, thru Delta, small isolated			2
3B	Intertie, thru Delta, small isolated, storage			3
3E	Intertie, thru Delta, large isolated, storage			4
3H	Intertie, thru Delta, small isolated, storage			3
3I	Intertie, thru Delta, large isolated, storage, multiple intakes			5

Ability to "make-up" water will be determined in more detailed modeling. Current evaluations are made based on assessment of available facilities to provide flexibility.

A higher ranking will be provided alternatives with more available facilities which increase flexibility.
A higher ranking will be provided alternatives which have a higher ability to "make-up" water potentially lost to protective actions.
Values are on a scale from 0 to 5; with 0 representing the least flexible and 5 representing the most.

E-015488

9.
SOUTH DELTA ACCESS TO WATER

South Delta Access to Water
Supporting Information

Local access to water in the south Delta channels may vary among the alternatives. Low channel stages (water levels) currently limit access to water. A relative qualitative ranking will depend on the location of the intakes for the south Delta pumping plants, conveyance configuration, use of flow barriers, and other equivalent measures.

Definition

"South Delta Access to Water" is a measure of how the alternatives affect local access to water due to changes in water levels in the channels.

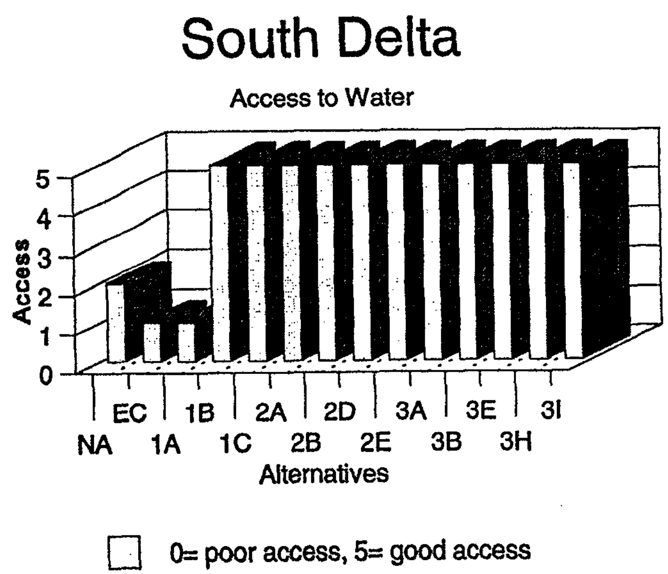
Summary

Other than alternative variation 1A, all alternatives provide good access to water due to including the flow barriers, improved south Delta hydraulics, or export from an isolated facility.

The chart at right and Table 9.1 show a measure of South Delta access to water for each alternative. A score of 0 shows little access and a score of 5 shows high level of access.

Supporting Information for Table 9.1

See Table 9.1.



E-015490

E-015491

9. South Delta Access to Water

Consider stage (water level) or other access to water from:
- thru Delta conveyance
- isolated conveyance (via direct connections)
- operable barriers
- other opportunities?

To Decision Matrix

Table 9.1 Summary

Alternative	Description of Access	Overall Score
Exist. Cond.	Existing access is limited by low water stages at times	2
No-action	Future access may be further limited by increased demand for water	1
1A	Alternative includes no improvements for access to South Delta water	1
1B	So. Delta barriers (or equivalent)improve access	5
1C	So. Delta barriers (or equivalent) improve access	5
2A	So. Delta barriers (or equivalent) improve access	5
2B	So. Delta barriers (or equivalent) improve access	5
2D	Improved hydraulics (or other methods) improve access	5
2E	Improved hydraulics (or other methods) improve access	5
3A	So. Delta barriers (or equivalent) improve access	5
3B	So. Delta barriers (or equivalent) improve access	5
3E	Elimination of majority of export pumping from So. Delta improve access	5
3H	Improved hydraulics, tie to isolated facility, or other methods) improve access	5
3I	Elimination of majority of export pumping from So. Delta improve access	5

Values are on a scale from 0 to 5; with 0 representing the worst performance and 5 representing the best performance.

E-015491

10.
RISK TO EXPORT WATER SUPPLIES

Risk to Export Water Supplies
Supporting Information

Risk to export water supply facilities and operations can change depending on the method of Delta conveyance and the amount of storage available to weather an interruption in exporting water. While the levee system integrity program seeks the same level of protection for all alternatives, risk to the export water supply is lessened by alternatives using an isolated Delta conveyance. The alternatives with the lowest risk to water supply will be given the highest ranking.

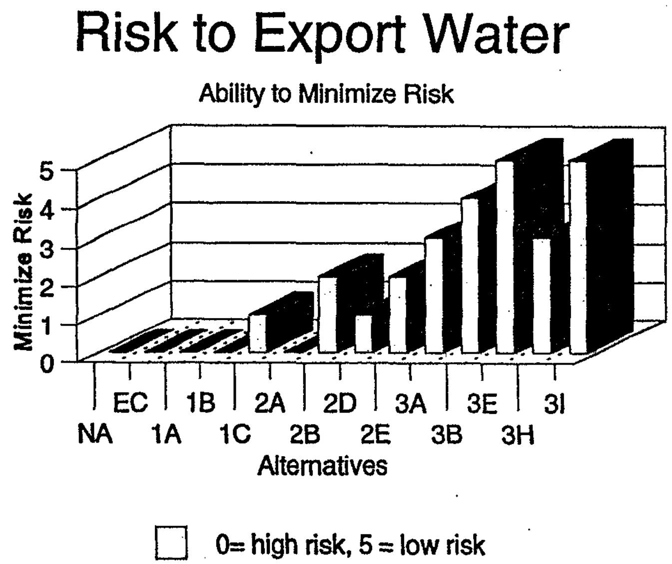
Definition

"Risk to Export Water Supplies" is intended to provide a measure which alternatives best reduce the risk to export water supplies from a catastrophic earthquake.

Summary

Those alternatives continuing to rely on Delta channels for conveyance of water to the export pumps have inherently more risk than those that don't. Alternatives with more storage are better able provide a reliable water supply incase the export system is shut down by an earthquake.

The chart at right shows how well each alternative minimizes risk to the export water supply. A score of 0 eliminates little or no risk compared with the existing condition and no-action alternative. A score of 5 eliminates most of the risk due to potential shut down from a catastrophic earthquake.



Supporting Information for Table 10.1

See table 10.1.

E-015493

10. Risk to Export Water Supplies

Consider:
- earthquake risk to conveyance
- flood risk to conveyance
- available storage south of Delta

To Decision Matrix

Table 10.1 Summary

Alternative	Description of Risk	Overall Score
Exist. Cond.	Relies all on Delta channels	0
No-action	Relies all on Delta channels	0
1A	Relies all on Delta channels	0
1B	Relies all on Delta channels	0
1C	Uses Delta channels but surface storage somewhat reduces risk	1
2A	Relies all on Delta channels	0
2B	Uses Delta channels but larger surface storage reduces risk	2
2D	Uses Delta channels but has mainly aqueduct storage	1
2E	Used Delta channels but larger surface storage reduces risk	2
3A	Small isolated facility significantly reduces risk for a portion of exports	3
3B	Small isolated facility and larger surface storage significantly reduces risk	4
3E	Large isolated facility significantly reduces risk for most exports	5
3H	Small isolated facility significantly reduces risk for a portion of exports	3
3I	Large isolated facility significantly reduces risk for most exports	5

Values are on a scale from 0 to 5; with 0 representing the highest risk and 5 represented the lowest risk.

E-015494

11.
TOTAL COST

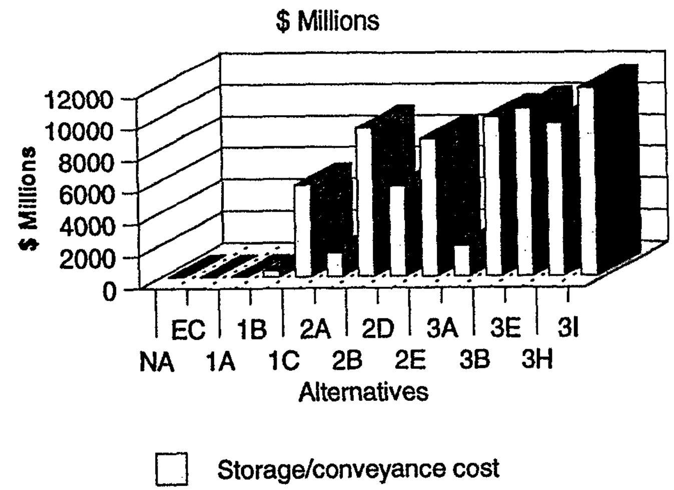
Total Cost
Supporting Information

Total costs will vary among alternatives. Initial capital costs and reoccurring annual costs will be estimated from prefeasibility analyses. All costs will be annualized or capitalized for comparison; alternatives with the lowest cost will be given the highest rank. This analysis will be performed under the assumption that the financial principles remain the same for each alternative but that a preliminary indication of cost breakdown between the general public and user groups may be available before comparison of all distinguishing characteristics.

Definition

"Total Cost" will include the initial capital costs for the Program and reoccurring annual costs. Initial costs will include study, design, permitting, construction, mitigation, acquisition, and other first costs of the Program. Annual costs will include operation and maintenance, monitoring, reoccurring annual purchases, and other annual costs.

Initial Capital Cost



Summary

Costs for the ecosystem restoration program plan, water quality program, water use efficiency program, and levee system integrity program have not been estimated. However, these will be relatively constant between the alternatives. The costs for the storage and conveyance facilities will increase directly with the number and size of those facilities in the alternatives. In general, the alternatives with only conveyance improvements are among the least expensive. Much of the variable cost of the alternatives is in the surface storage facilities. However, the storage sizes in the alternatives are intended to define the outer range of potential impacts in the EIR/EIS. Further analysis of these sizes will likely lower the effective storage sizes and costs of the alternatives. **The above chart shows preliminary estimates of initial capital costs for storage and conveyance facilities only. Since lower costs are the most desirable, Table 11.1 provides a score of "5" to the lowest costs and a score of "0" to the highest costs.**

11. Total Cost

Initial Cost (present value and annualized costs for time sequence):
- Study, design & permitting
- Construction
- Mitigation
- Other

Annual Costs (present value and annualized costs for time sequence:)
- Operation and maintenance
- Monitoring
- Reoccurring annual purchases
- Other

To Decision Matrix

Table 11.1 Summary

Alternative	Initial Cost $Million	Annual Cost $ Million/Yr	Overall Score
Exist. Cond.	NA	NA	5
No-action	NA	NA	5
1A	0	0	5
1B	390	3	4
1C	5,700	45	3
2A	1,500	12	4
2B	9,300	75	1
2D	5,600	45	3
2E	8,600	69	1
3A	1,900	15	4
3B	10,000	81	1
3E	10,500	84	1
3H	9,600	77	1
3I	11,800	95	1

Assume $ 4,000 Million for common programs only to see change in rankings

Initial Cost $Million		Overall Score
NA		5
NA		5
0 +	4,000	4
390 +	4,000	4
5700 +	4,000	3
1500 +	4,000	4
9300 +	4,000	2
5600 +	4,000	2
8600 +	4,000	2
1900 +	4,000	4
10000 +	4,000	1
10500 +	4,000	1
9600 +	4,000	1
11800 +	4,000	1

Cost of the ecosystem, water quality, water use efficiency, and levee system integrity program not yet included.
Table includes $ for storage and conveyance facilities only.
Lower costs will be provided the highest ranking.
Values are on a scale from 0 to 5; with 0 representing the most expensive and 5 representing the least.

E-015497

Supporting Information for Table 11.1

Estimating of costs for the alternatives is in progress. At this time, only preliminary estimates of storage and conveyance facility costs are available. Therefore, Table 11.1 does not currently include costs for any of the 4 common programs.

The estimates in Table 11.1 were derived from:

<u>CVP-SWP Improvements</u>
Cost were taken from, CALFED's "Facility Descriptions and Updated Cost Estimates for an **Improved Through Delta Conveyance Facility**", (Table 4), June 24, 1997. To account for mitigation, costs were increased by 15 percent.

<u>South Delta Improvements</u>
Cost were taken from, CALFED's "Facility Descriptions and Updated Cost Estimates for an **Improved Through Delta Conveyance Facility**", (Table 4), June 24, 1997. To account for mitigation, costs were increased by 15 percent.

<u>North Delta Improvements</u>
Costs were taken from, DWR's, "Draft Environmental Impact Report and Impact Statement **North Delta Program**", November 1990. Costs are from Table H-1, Alternative 5A and included only enlarging the North Fork of the Mokelumne River. The cost were increased by 15 percent for mitigation and 11 percent for escalation (increase in costs) from November 1990 to October 1996.

<u>Alternative 2B - Intake, Pumping Plant, Glanville and Mc Cormack-Williamson Tracks</u>
Cost were taken from, CALFED's "Facility Descriptions and Updated Cost Estimates for an **Improved Through Delta Conveyance Facility**", (Table 4), June 24, 1997. To account for mitigation, costs were increased by 15 percent.

<u>3.0 MAF Upstream Storage Sacramento River</u>
To forecast a general cost of 3.0 MAF of surface storage in the Sacramento Valley, the cost of two large storage complexes were averaged (Colusa and Thomas-Newville). The 3.3 MAF Colusa Reservoir complex is offstream with conveyance facilities of a new canal paralleling the Tehama-Colusa (T-C) Canal from Red Bluff diversion Dam to Funks Reservoir and a new connection from the Sacramento River at Chico landing to the T-C Canal (conveyance options 2b & 4). The 3.08 MAF Thomes-Newville complex is offstream with a new canal adjacent to the T-C canal from RedBluff to Sour Grass Canal (conveyance option 2f). The cost of these facilities were derived from CALFED's, "Facility Descriptions and Updated Cost Estimates for: Sites/Colusa

E—015498

Reservoir, June 24, 1997; Thomes-Newville Reservoir Project, June 23,1997; Chico Landing Intertie, March 25, 1997; Tehama-Colusa Canal Enlargement, June 24,1997; and, Tehama-Colusa Canal Extension, June 25,1996.

500 TAF Upstream Storage San Joaquin River

Cooperstown, a proposed 609 TAF offstream reservoir, was used to estimate the general cost for 500 TAF of storage in the San Joaquin valley.

2.0 MAF Aqueduct Storage

Garzas, proposed 2.0 MAF offstream reservoir, was used to estimate the general cost for 2.0 MAF of storage on the aqueduct.

1.0 MAF Aqueduct Storage

The general cost of 1.0 MAF of aqueduct storage was derived by combining the cost of a 600 TAF offstream Sunflower reservoir and a 401 TAF offstream Ingram reservoir.

250 TAF Groundwater storage in the Sacramento Valley

The cost of 250 TAF active groundwater storage was estimated by summing and porportioning the cost of: Butte Basin (pg B-5); and Stoney Creek Fan (pg B-12) from the CALFED report "CALFED Bay-Delta Program Storage and Conveyance Inventories", February 5, 1997. To account for mitigation, costs were increased by 15 percent.

500 TAF Groundwater storage in the San Joaquin Valley

The cost of 500 TAF active groundwater storage was estimated by summing the cost of: Southeastern San Joaquin County (pg B-16); and Kern County (pg B-20) from the CALFED report "CALFED Bay-Delta Program Storage and Conveyance Inventories", February 5, 1997. To account for mitigation, costs were increased by 15 percent.

200 TAF In-Delta Storage

Cost were taken from, CALFED's "Facility Descriptions and Updated Cost Estimates for the **In-Delta Storage Project**", (Table 3, June 24, 1997. To account for mitigation, costs were increased by 15 percent.

E-015499

5,000 cfs Isolated Facility
Cost were taken from, CALFED's "Facility Descriptions and Updated Cost Estimates for an **Isolated Delta Conveyance Facility**", (Table 3), March 28,1997. To account for mitigation, costs were increased by 15 percent.

General Allowances (assume that all of these are included in the above figures)
Contingency Costs (15%)
Engineering, Legal, and Project Administration (35%)
Mitigation Costs (15%)
Operation and Maintenance (0.8%)

Cost estimates for the four common programs are not available at this time.

Information in Table 11.1 and this supporting information will be updated as more detailed costs become available.

E-015500

12.
ASSURANCES DIFFICULTY

Assurances Difficulty
Supporting Information

The assurances are the package of institutional and physical features which basically "guarantee" that the Program operates in the future as designed. It is assumed that an adequate assurances package can be put together to satisfy the needs of each alternative. However, some assurances will be more difficult to obtain due to differences in how people perceive they will function.

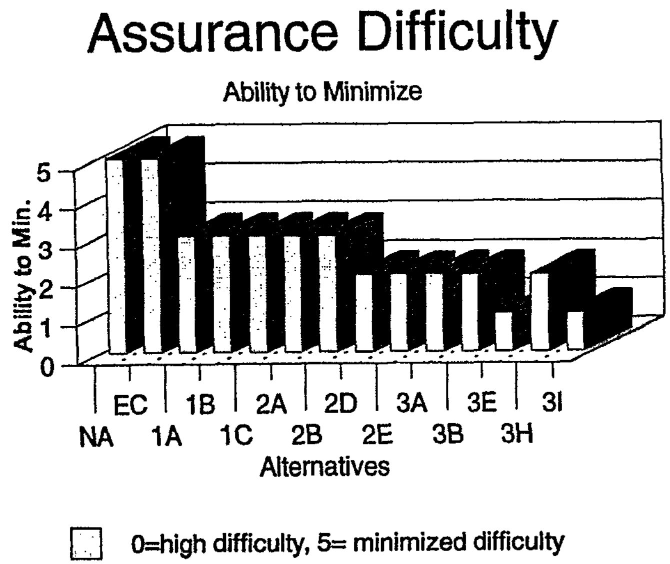
Definition

"Assurances Difficulty" is an estimate on how hard an assurance package will be to formulate and get consensus among agencies and stakeholders. It is not an assessment on the perceived effectiveness of the assurance package.

Summary

Generally, the alternatives that trend away from the status quo will be the ones with the most difficult assurance packages to obtain. Therefore, the alternative 1 variations generally will be easier to "assure" than the alternative 2 variations. Likewise, the alternative 2 variations will be easier to "assure" than the alternative 3 variations.

The chart at the right shows estimates of how well the alternatives minimize the difficulty of obtaining assurances. The chart and Table 12.1 provide a score of "0" to the alternatives that have considerable assurance difficulty (do not minimize difficulty) and "5" to the alternatives that do the best to minimize assurances difficulty.



Supporting Information for Table 12.1

See Table 12.1.

E-015502

12. Assurances Difficulty

Qualitative assessment considering the sizes and complexity of storage and conveyance facilities. The difficulty in developing workable assurances will increase incrementally with increased modifications to the existing system.

To Decision Matrix

Table 12.1 Summary

Alternative	Storage/Conveyance Facility Description	Overall Score
Exist. Cond.	No assurance package needed.	5
No-action	No assurance package needed	5
1A	No storage/conveyance facilities but difficulty meeting Program objectives will complicate assurances.	3
1B	Minor storage/conveyance facilities but difficulty meeting Program objectives will complicate assurances.	3
1C	Storage and south Delta modifications	3
2A	Through Delta modifications and no surface storage	3
2B	Through Delta modifications with surface storage	3
2D	Surface storage and uncertainty on through Delta conveyance/habitat	2
2E	Surface storage and uncertainty on large through Delta conveyance/habitat	2
3A	Small isolated conveyance and no surface storage; some will object to any isolated conveyance.	2
3B	Small isolated conveyance and surface storage; some will object to any isolated conveyance.	2
3E	Large isolated facility with surface storage; isolated difficult to assure.	1
3H	Uncertainty on large through Delta conveyance/habitat; isolated difficult to assure.	2
3I	Large isolated facility with surface storage; isolated difficult to assure.	1

Values are on a scale from 0 to 5; with 0 representing the most difficult to assure and 5 the easiest to assure.

13.
HABITAT IMPACTS

Habitat Impacts
Supporting Information

Habitat impacts from implementing each alternative will vary. This information will be available directly from the impact analysis for the EIR/EIS and will depend on the total quantity and quality of the impacted habitat for each alternative. Initial judgements were that these impacts could be beneficial or adverse. Due to the large amount of habitat restoration with the ecosystem restoration program plan in each alternative, the amount of beneficial impacts will be relatively constant between alternatives. The primary adverse impacts are from the storage and conveyance facilities but these too are relatively small, especially since all adverse impacts will be mitigated.

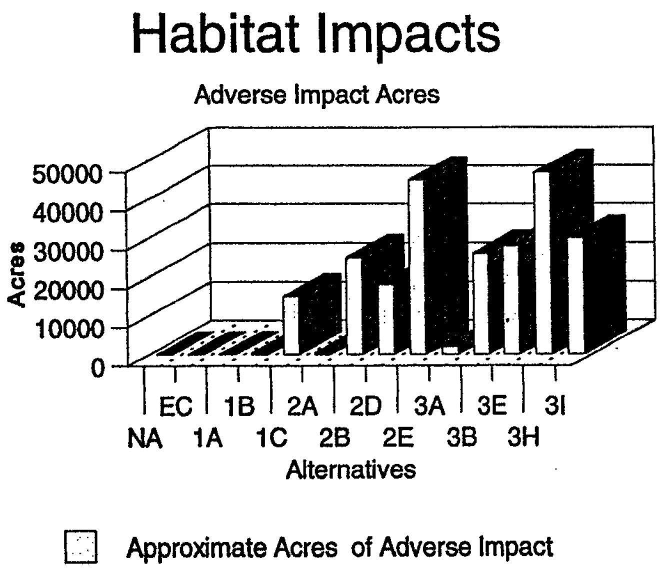
Definition

At this time, "Habitat Impacts" are the adverse habitat impacts due to implementation of the storage and conveyance facilities.

Summary

The alternatives that minimize the adverse habitat impacts are those without significant new storage and conveyance facilities. In general, less than 40,000 acres are impacted by the storage and conveyance facilities. Therefore, alternative variations 1A and 1B have the least adverse impact.

The chart at the right shows preliminary estimates of acres of habitat adversely impacted by the alternatives. Since lower impacted acres are the most desirable, Table 13.1 provides a score of "5" to the lowest impacts and a score of "0" to the highest impacts.



Supporting Information for Table 13.1

See table 13.1.

13. Habitat Impacts

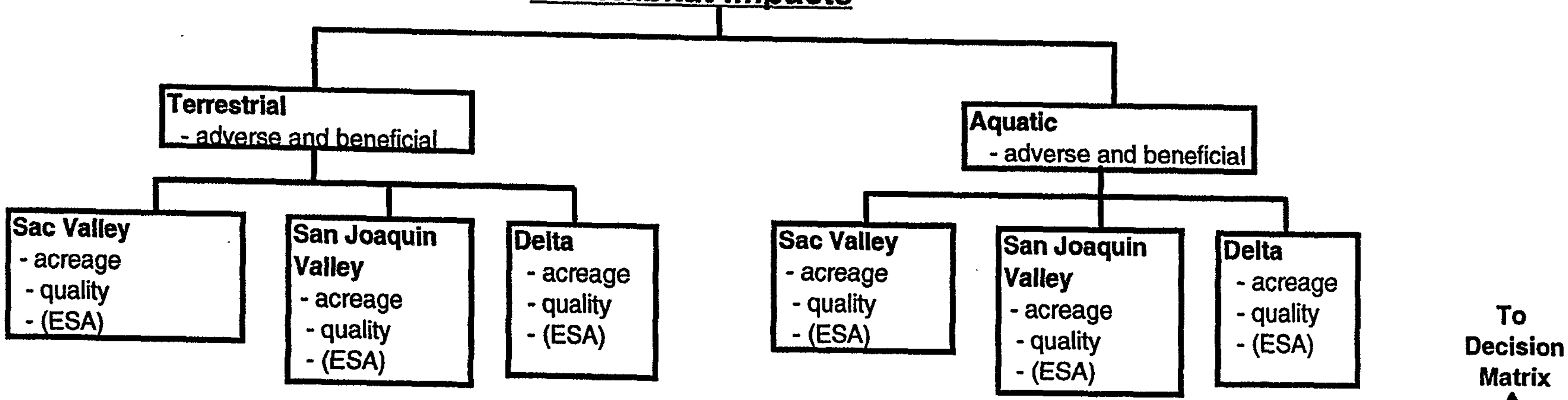


Table 13.1 Summary

	Adverse Impacts						Beneficial Impacts						
	Terrestrial			Aquatic			Terrestrial			Aquatic			Overall
Alternative	Acreage	Quality	ESA	Acreage	Quality	ESA	Acreage	Quality	ESA	Acreage	Quality	ESA	Score
Exist. Cond													5
No-action													5
1A													4
1B													4
1C													3
2A													4
2B													3
2D													3
2E													2
3A													4
3B													3
3E													3
3H													2
3I													3

Detailed numbers are not yet available. All alternatives have approximately 150,000 acres of restored habitat from the ecosystem restoration program plan so the beneficial impacts are relatively the same between alternatives. Adverse habitat impacts result primarily from construction of storage and conveyance facilities. This is generally less than 40,000 acres for most alternatives. This acreage is relatively small compared with the acreage improved by the ecosystem restoration program plan. The adverse habitat impacts from implementation of the storage and conveyance facilities will be further reduced due to mitigation.

Summarized from regions on following sheets (when more detailed information is available)
Values are on a scale from 0 to 5; with 0 representing the most adverse habitat impacts and 5 representing the least.

E-015506

14.
LAND USE CHANGES

E-015508

Land Use Changes
Supporting Information

Land use changes will vary by alternative. This information will ultimately be available directly from the impact analysis for the EIR/EIS.

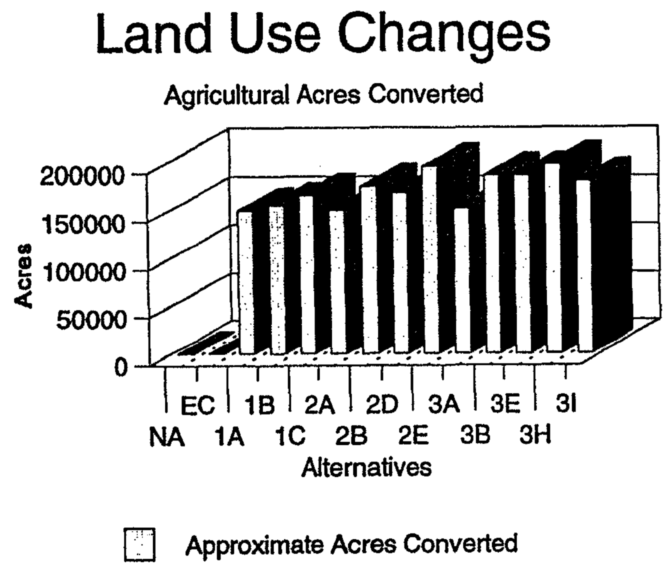
Definition

"Land Use Changes" is a measure primarily of the amount of agricultural land that would change to other uses by implementation of the Program.

Summary

All alternatives result in conversion of approximately 150,000 acres of agricultural land for implementation of the ecosystem restoration program plan. Conversion for the water use efficiency program, water quality program, and levee system integrity program is very small in comparison. Alternatives with storage and conveyance facilities require conversion of additional acreage but is also relative small in comparison.

The chart at the right shows preliminary estimates of acres of agricultural land converted to other uses by the alternatives. Since lower impacted acres are the most desirable, Table 14.1 provides a score of "5" to the lowest conversion and a score of "0" to the highest conversion.



Supporting Information for Table 14.1

See Table 14.1.

E-015508

14. Land Use Changes

- Sac Valley
  - Prime & unique ag. land
    - acreage
  - Other
    - acreage
    - type
- San Joaquin Valley
  - Prime & unique ag. land
    - acreage
  - Other
    - acreage
    - type
- Delta
  - Prime & unique ag. land
    - acreage
  - Other
    - acreage
    - type
- Other Areas
  - Prime & unique ag. land
    - acreage
  - Other
    - acreage
    - type

To Decision Matrix

Table 14.1 Summary

	Sac Valley			San Joaquin Valley			Delta			Other Areas			
Alternative	Prime ag. (acreage)	Other (acreage)	Other (type)	Prime ag. (acreage)	Other (acreage)	Other (type)	Prime ag. (acreage)	Other (acreage)	Other (type)	Prime ag. (acreage)	Other (acreage)	Other (type)	Overall Score
Exist. Cond.													5
No-action													5
1A													3
1B													3
1C													2
2A													3
2B													2
2D													2
2E													1
3A													3
3B													2
3E													2
3H													1
3I													3

Detailed numbers are not yet available. All alternatives have approximately 150,000 acres of agricultural land converted due to the ecosystem restoration program plan. The conversion by the water quality, water use efficiency, and levee system integrity program are small in comparison. The conversion required by the storage and conveyance facilities is also relatively small in comparison and is generally less than 20 percent of that converted by the ecosystem restoration program plan. Therefore, most alternatives will convert between 150,000 and 190,000 acres. Alternatives 2E and 3H would convert an approximately an additional 30,000 to 40,000 acres and are therefore rated the lowest.

The least land use change will be provided the highest ranking.
Values are on a scale from 0 to 5; with 0 representing the most land use changes and 5 representing the least.

15.
SOCIO-ECONOMIC IMPACTS

Socio-economic Impacts
Supporting Information

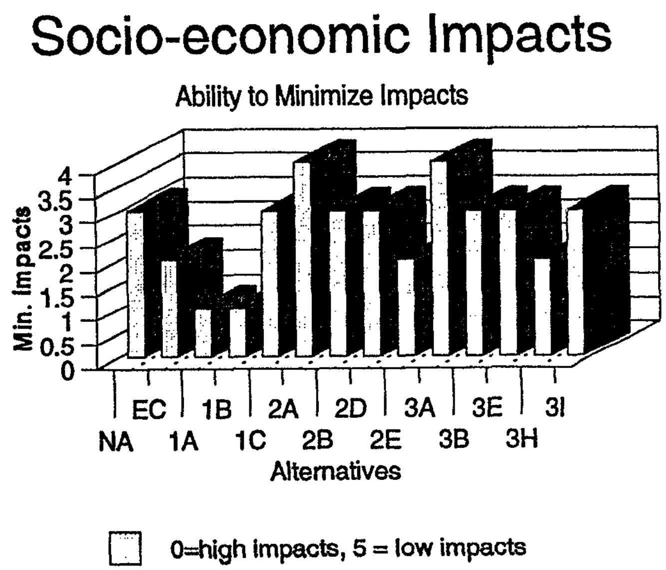
Socio-economic impacts will vary among the alternatives. The highest rank will be given the alternatives with the least socio-economic impacts.

Definition

"Socio-economic Impacts" include adverse and beneficial impacts such as commercial and recreational fishing, farm workers, power production, economic cost of increased conservation, and other third party impacts.

Summary

Neither adverse or beneficial socio-economic impacts have yet been evaluated in detail. At this time, only qualitative assessments of the adverse socio-economic impacts are shown. The beneficial socio-economic impacts require more complete economic analyses. Alternative variations 1A and 1B are judged to have the most adverse socio-economic impacts due to the amount of agricultural land and water needed to be purchased for the environmental program. Alternative variations 2E and 3H have relatively high impacts due to the large conversion of in-Delta agricultural land to in-Delta water conveyance/habitat. Socio-economic impacts are not a major discriminator for the other alternatives.



The chart at the right shows preliminary estimates of how the alternatives can minimize socio-economic impacts. Since lower impacted acres are the most desirable, Table 15.1 provides a score of "5" to the lowest impacts and a score of "0" to the highest impacts.

Supporting Information for Table 15.1

See summary above and table 15.1.

E-015512

15. Socio-Economic Impacts

- **Sac Valley** (adverse and beneficial)
  - $ change ag. production
  - water purchases (AF)
  - third party
  - other (social well being)
- **San Joaquin Valley** (adverse and beneficial)
  - $ change ag. production
  - water purchases (AF)
  - third party
  - other (social well being)
- **Delta** (adverse and beneficial)
  - $ change ag. production
  - water purchases (AF)
  - third party
  - other (social well being)
- **Other** (adverse and beneficial)
  - power/energy (Kw/Kwh)
  - commercial and rec. fishing
  -
  -

To Decision Matrix

Table 15.1 Summary

Alternative	Adverse Impacts						Beneficial Impacts						Overall Score
	$ ag. prod.	AF water purch.	Third Party	Other	Other	Other	$ ag. prod.	AF water puch.	Third Party	Other	Other	Other	
Exist. Cond													3
No-action													2
1A													1
1B													1
1C													3
2A													4
2B		Qualitative assessment until detailed evaluations are complete						No assessment until detailed evaluations are complete. Mostly addressed by other distinguishing characteristics.					3
2D													3
2E													2
3A													4
3B													3
3E													3
3H													2
3I													3

Values are on a scale from 0 to 5; with 0 representing the most adverse socio-economic impacts and 5 representing the least.

E—015512

16.
CONSISTENCY WITH SOLUTION PRINCIPLES

Consistency with Solution Principles Supporting Information

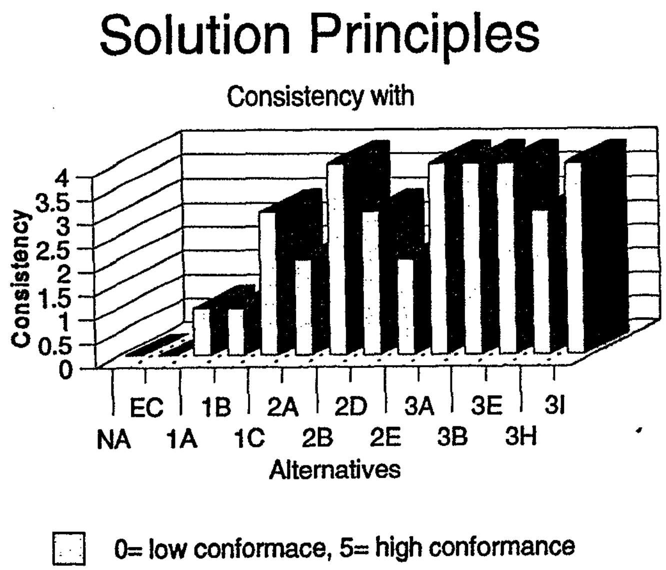
Solution principles have been at the root of CALFED alternative development since the first phase of the Program. Solution principles embody the balancing (considering tradeoffs and incremental differences between alternatives) of all the distinguishing characteristics. The relative qualitative rankings of the alternatives against the solution principles consider alternative cost, assurances, ability to satisfy the Program objectives, and to minimize impacts.

Definition

"Consistency with Solution Principles" provides a qualitative measure of how well the alternatives meet the Program solution principles.

Summary

Alternative variations 1A and 1B do not satisfy the Program ecosystem objectives since they continue to have major diversion impacts (entrainment) on fisheries. Also, these variations do not satisfy the Program water supply reliability objectives since they do little to reduce the mismatch between water supply and the needs for the water. They also have the most adverse socio-economic impacts since needed water for environmental uses must be purchased from water users. Most of the other alternatives can be implemented in more balanced ways.



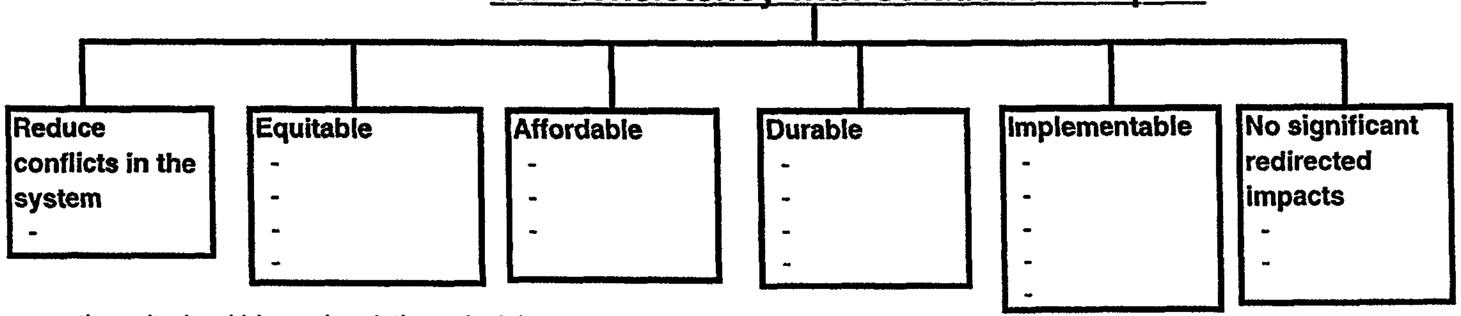
The chart at right and Table16.1 show how well each alternative meets the Program solution principles. A score of 0 shows little or no consistency with the solution principles. A score of 5 shows high consistency with solution principles.

Supporting Information for Table 16.1

Table 16.1 includes summary rational for each rating. These will be refined as CALFED agencies and stakeholders evaluate the performance of the alternatives.

E-015514

16. Consistency with Solution Principles



Consider the supporting criteria within each solution principle.

To Decision Matrix

Table 16.1 Summary

Alternative	Reduce Conflicts	Equitable	Affordable	Durable	Implementable	No Significant Redirected Impacts	Overall Score
Exist. Cond.	poor	poor	NA	poor	NA	NA	**0**
No-action	poor	poor	NA	poor	NA	NA	**0**
1A	poor	poor	high	poor	fair	poor	**1**
1B	poor	poor	high	poor	fair	poor	**1**
1C	good	good	fair	fair	good	good	**3**
2A	fair	fair	good	fair	good	good	**2**
2B	good	good	fair	good	good	good	**4**
2D	good	good	fair	good	fair	good	**3**
2E	good	good	fair	fair	poor	fair	**2**
3A	good	good	good	fair	fair	good	**4**
3B	good	good	fair	good	fair	good	**4**
3E	good	good	fair	good	poor	good	**4**
3H	good	good	fair	good	fair	fair	**3**
3I	good	good	poor	good	poor	good	**4**

The best conformance with solution principles will be provided the highest ranking.
Values are on a scale from 0 to 5; with 0 representing the least conformance with solution principles and 5 representing the most.

E-015515

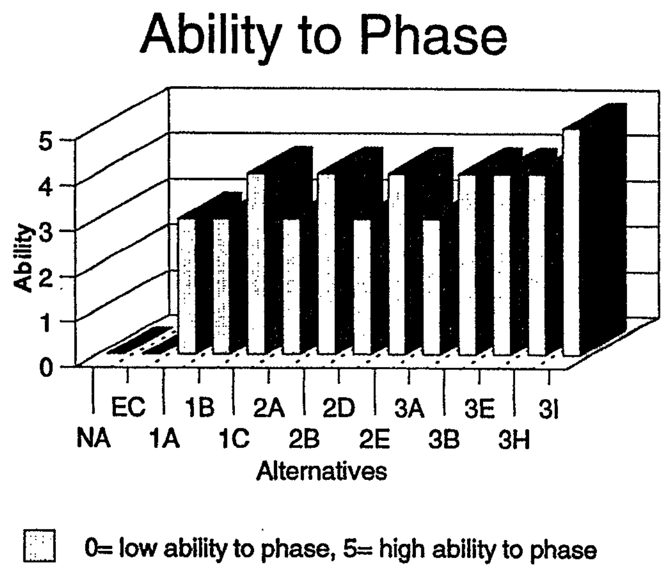
17.
ABILITY TO PHASE FACILITIES

Ability to Phase Facilities
Supporting Information

Some alternatives will be easier to phase over time the various components. Since the ecosystem restoration program plan, water quality program, water use efficiency program, and levee system integrity program remain relatively the same for each alternative, there is little difference on how they can be phased. Each of these four programs is comprised of may separate parts that can be easily phased over time. Relative qualitative rankings will show which alternatives are easiest to phase for the storage and conveyance facilities.

Definition

"Ability to Phase Facilities" provides an indication on how easy it will be to phase implementation of storage and conveyance facilities over time.



Summary

Each alternative is comprised of programs for ecosystem, water quality, water use efficiency, and levee system vulnerability which are equally easy to phase. Since storage and conveyance facilities generally have long implementation times, they can add to the phasing of the alternatives. All alternatives are almost equally easy to phase. Those alternatives with significant storage will likely require additional phasing over those with no storage. Alternative 3I, with the most storage and conveyance facilities, would require the most phases to implement.

The chart at right and Table 17.1 show judgements on how well each alternative can be phased. A score of 0 indicates little or no ability to phase the alternative. A score of 5 shows high ability to phase the alternative.

Supporting Information for Table 17.1

See summary above.

E—015517

E-015518

17. Ability to Phase Facilities

Qualitative
- South Delta export capacity
- Upstream storage (AF)
- Aqueduct storage (AF)
- Isolated facility (cfs)
- In-Delta storage (AF)
- Alternate diversion points
- Groundwater

To Decision Matrix

Table 17.1 Summary

Alternative	Description of Facility Phasing	Overall Score
Exist. Cond.	All alternatives are almost equally easy to phase. Those alternatives with significant storage will likely require additional phasing over those with no storage. Alternative 3I, with the most storage and conveyance facilities, would require the most phases to implement.	-
No-action		-
1A		3
1B		3
1C		4
2A		3
2B		4
2D		3
2E		4
3A		3
3B		4
3E		4
3H		4
3I		5

Values are on a scale from 0 to 5; with 0 representing the least phasable and 5 representing the most phasable.

E—015518

18.
BRACKISH WATER HABITAT

Brackish Water Habitat
Supporting Information

Delta outflows in excess of existing Delta standards provide a degree of fishery protection not covered by the other distinguishing characteristics. While operating to meet Delta standards, some alternatives may operate closer to the standards more frequently than do other alternatives. Currently available methods do not directly equate fishery protection with Delta outflow. However, the X2 (approximate location of 2000 parts per million of total dissolved solids) standard may provide an indication of improved or diminished protection for the fishery as outflows increase or decrease. The location of X2 affects the area/volume of the brackish water habitat and the value of this habitat varies with time of the year.

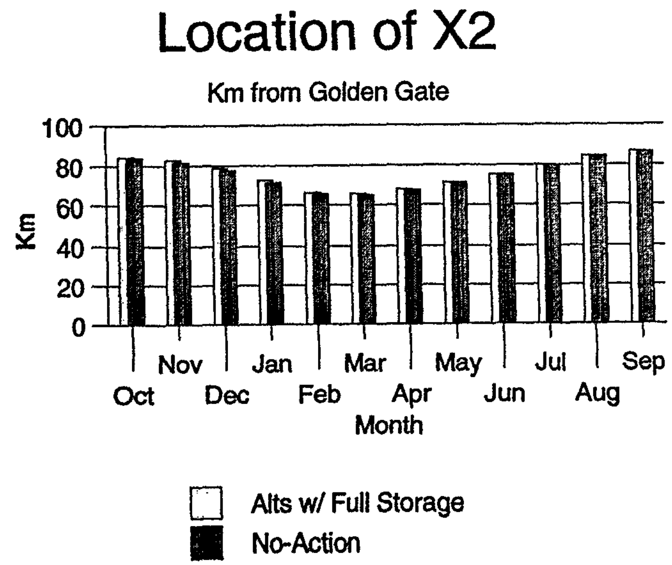
Definition

"Brackish Water Habitat" in the Western Delta is the aquatic habitat with salinity levels of approximately 2000 parts per million. The location of X2 is an indicator of changes of brackish water habitat between the alternatives.

Summary

Since the modeling assumes that Delta standards will be met, there is little change in X2 location between the alternatives. Some small reduction in the number of X2 days for alternatives exporting more water will likely be shown as more detailed modeling progresses. However, these potential changes are assumed at this time to be insignificant.

The chart at right and Table 18.1 show a summary of the average location of X2 for various months of the year for water years 1922 to 1992. The chart shows insignificant changes in X2. Therefore, habitat changes are assumed to be insignificant between alternatives. In Table 18.1, all alternatives were given the same score of "3".



18. Brackish Water Habitat

Critical Year, extent of brackish water habitat (compare with existing standards)
- # days X-2 (duration)
- location and surface area/volume
- time of year

Average Year extent of brackish water habitat (compare with existing standards)
- # days X-2 (duration)
- location and surface area/volume
- time of year

To Decision Matrix

Table 18.1 Summary

Alternative	Critical year: # days X-2	Critical year: Location/area/volume	Critical year: Time of year	Average year: # days X-2	Average year: Location/area/volume	Average year: Time of year	Overall Score
Exist. Cond	Some reduction in number of X2 days with more export from Delta. Detailed modeling not available at this time but not expected to be significant.	Location of X2 does not vary significantly between alternatives by time of year		Some reduction in number of X2 days with more export from Delta. Detailed modeling not available at this time but not expected to be significant.	Location of X2 does not vary significantly between alternatives by time of year		3
No-action							3
1A							3
1B							3
1C							3
2A							3
2B							3
2D							3
2E							3
3A							3
3B							3
3E							3
3H							3
3I							3

Values are on a scale from 0 to 5; with 0 representing the least habitat and 5 representing the most habitat.

Supporting Information for Table 18.1

The amount of brackish water habitat can vary by alternative and time of year depending on the Delta outflow.

Preliminary DWRSIM model runs provide an indication of how X2 can change. Since preliminary DWRSIM model runs have not been made for all alternatives, four runs were made to cover the range of the existing conditions, no-action alternative, and CALFED alternatives:

- Case 469; existing conditions.
- Case 472; no-action alternative.
- Case 472b; no-action alternative and South Delta modifications to increase South Delta permitted export capacity to the physical capacity. This will show approximate data for alternatives that do not have associated storage.
- Case 510; no-action alternative, South Delta modifications to increase South Delta permitted export capacity to the physical capacity, and North & South (aqueduct storage) of Delta surface storage. This will show approximate data for alternatives that have significant surface storage.

The preliminary data on the location (kilometers upstream of the Golden Gate) are shown by month for four different flow periods. The **first chart** shows a comparison of computed X2 position for water years 1922 thru 1992. Case 472b and case 510 do not show significant movements of the X2 location in comparison with the no-action alternative. For example, case 510 shows an average upstream movement of only about 0.3 km in the November through June period compared with the no-action alternative. This is not a significant change in habitat.

The **second chart** shows a comparison of computed X2 position for the dry/critical years of the 1922 thru 1992 period. Case 472b and case 510 do not show significant movements of the X2 location in comparison with the no-action alternative. For example, case 510 shows an average upstream movement of only about 0.2 km in the November through June period compared with the no-action alternative. This is not a significant change in habitat.

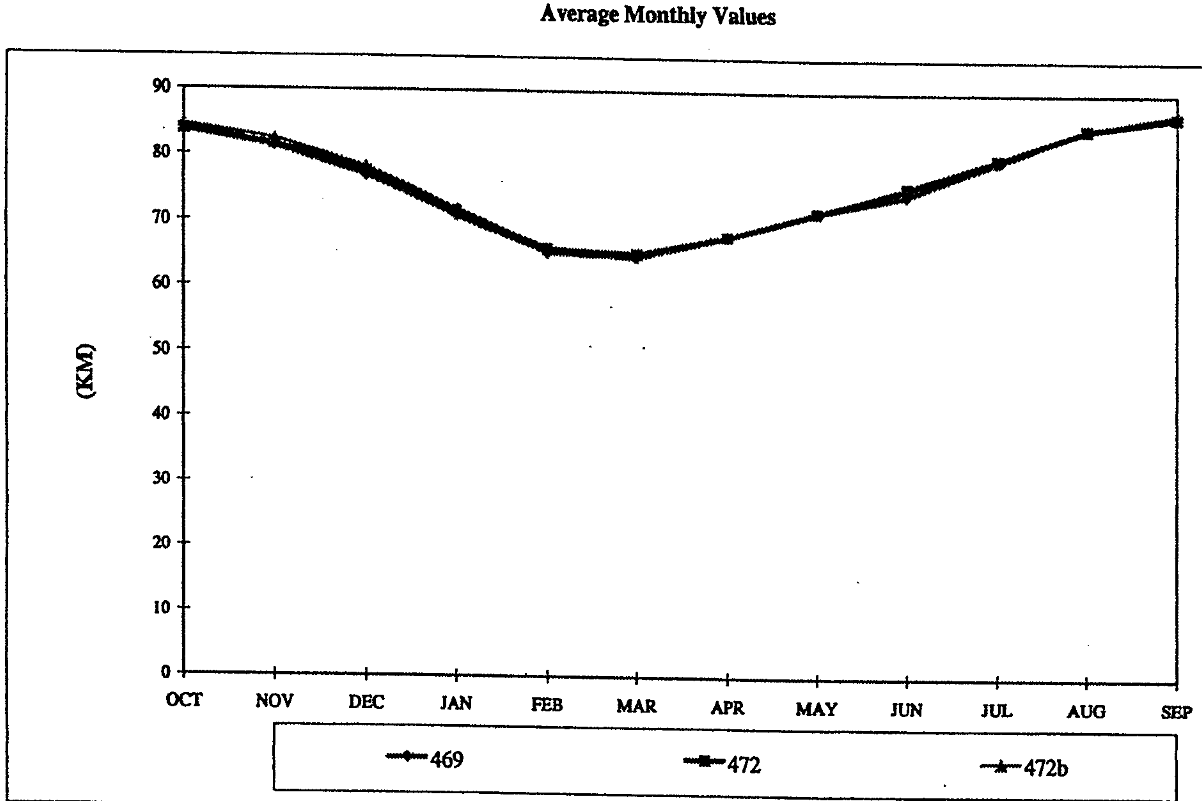
The **third chart** shows a comparison of water years 1928 through 1934 (the critical dry period in California). Case 472b and case 510 do not show significant movements of the X2 location in comparison with the no-action alternative. For example, case 510 shows an average upstream movement of only about 0.2 km in the November through June period compared with the no-action alternative. This is not a significant change in habitat.

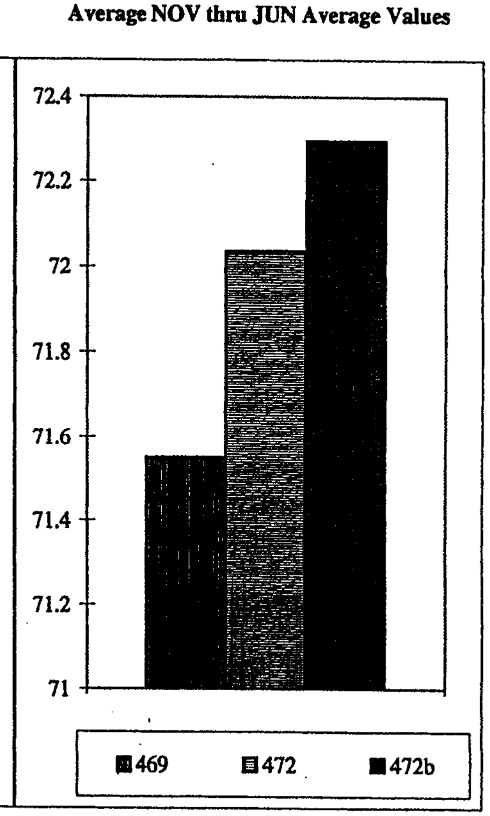
The **fourth chart** shows a comparison of water years 1987 thru 1992 (the recent dry period in California). Case 472b and case 510 do not show significant movements of the X2 location in comparison with the no-action alternative. For example, case 510 shows an average upstream movement of only about 0.2 km in the November through June period compared with the no-action alternative. This is not a significant change in habitat.

The number of X2 days cannot be estimated with the current monthly modeling in DWRSIM. More detailed modeling will be conducted as studies progress. Some decrease in the number of X2 days can be expected for the alternatives with increased export from the Delta compared with the no-action alternative. However, considering that in most cases the increase in export is only several hundred thousand acre-feet, the reduction in X2 days is not expected to be significant.

Comparison of Computed X2 Position Under Various Delta Alternatives

Data Selected from WYear1922 thru 1992





Case	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	SUMMARY	Case Description
469	83.8	81.3	76.9	70.8	65.3	64.6	67.7	71.5	74.3	79.5	84.7	86.5	71.6	Existing Conditions
472	83.8	81.6	77.5	71.6	65.8	65.1	67.8	71.5	75.3	79.8	84.6	86.5	72.0	No Action
472b	84.5	82.5	78.1	71.8	65.8	65.2	67.9	71.6	75.4	79.9	84.7	87.0	72.3	No Action + SDI
510	84.4	82.7	78.6	72.8	66.5	65.7	68.2	71.7	75.4	79.9	84.7	86.9	72.7	No Action + SDI + NDSS + SDSS

SDI = So. Delta Improvements
NDSS = No. Delta Surface Storage
SDSS = So. Delta Surface Storage

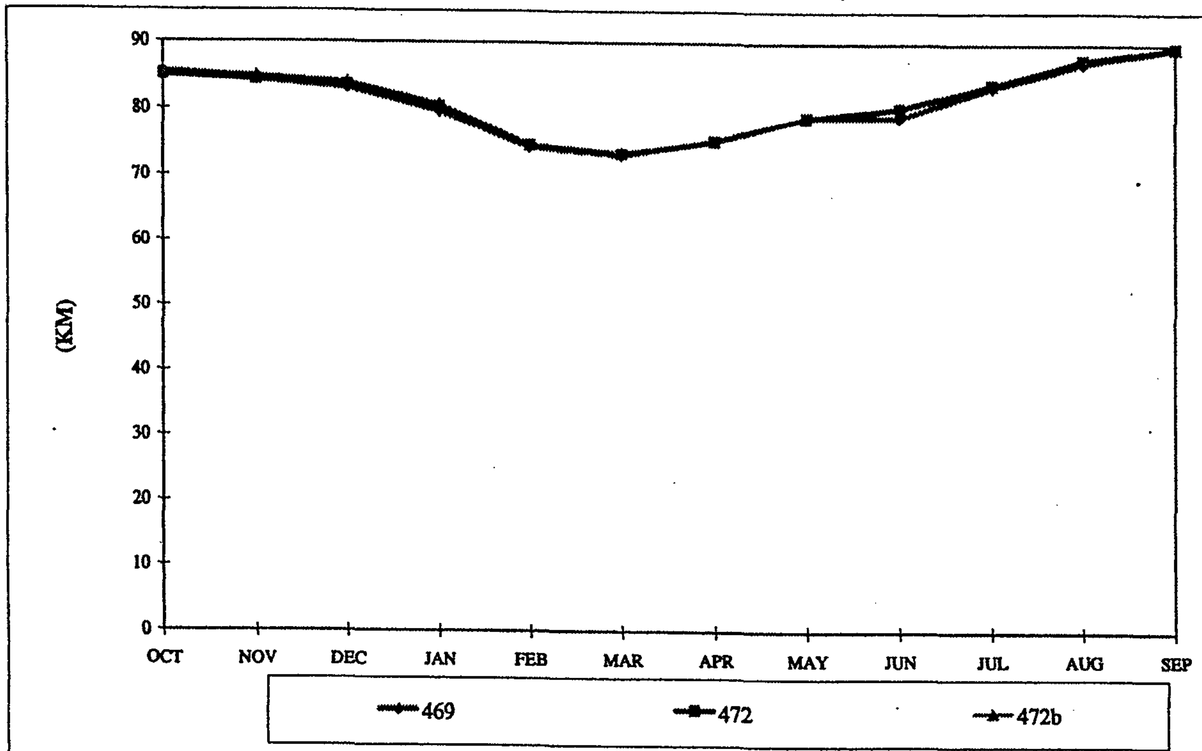
MWD-BDGM-9/19/97-5:06 PM

E-015524

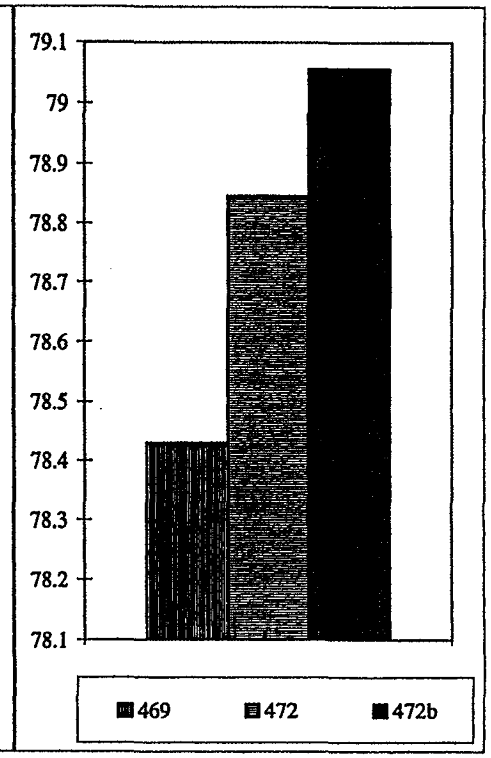
Comparison of Computed X2 Position Under Various Delta Alternatives

Data Selected from WYear1922 thru 1992 & 4<=WYType<=5

Average Monthly Values



Average NOV thru JUN Average Values



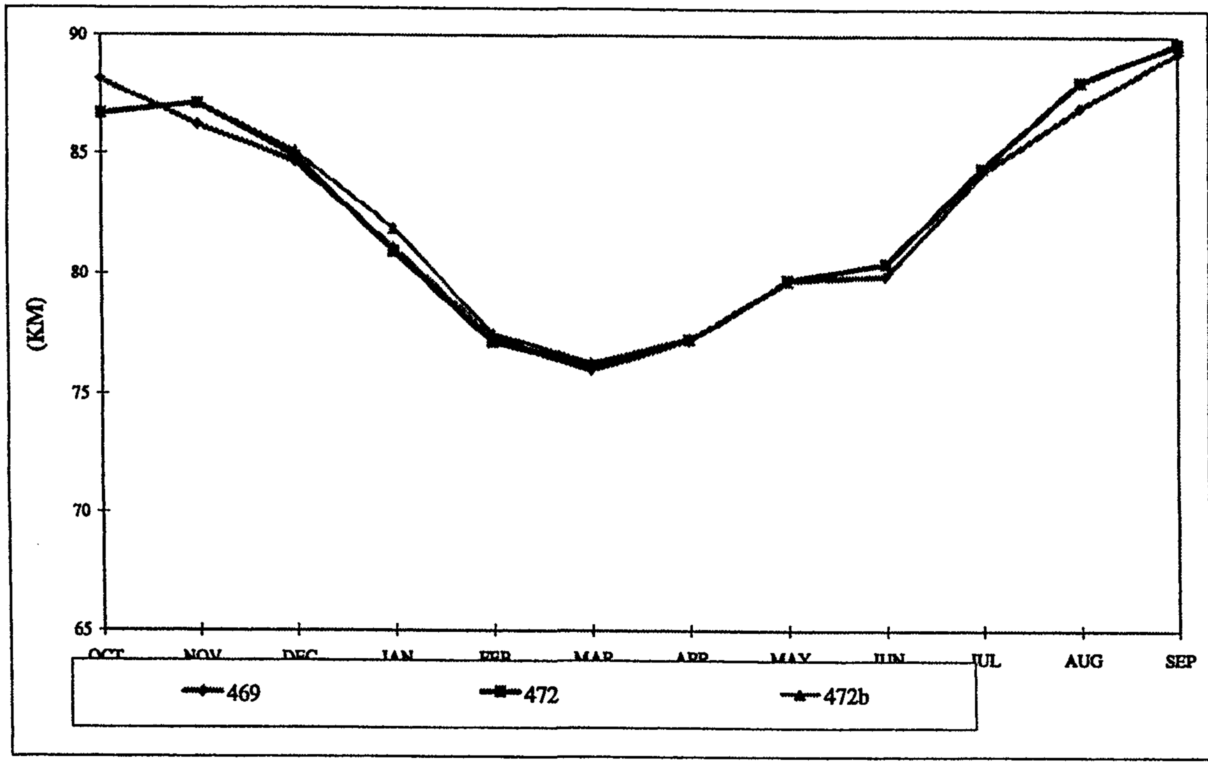
Case	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	SUMMARY	Case Description
469	85.5	84.2	83.1	79.6	74.3	73.0	75.4	78.9	79.0	83.5	87.2	89.4	78.4	Existing Conditions
472	85.1	84.4	83.6	80.3	74.6	73.3	75.3	78.9	80.3	83.9	87.6	89.5	78.8	No Action
472b	85.7	84.9	84.1	80.6	74.8	73.5	75.4	78.9	80.3	83.9	87.6	89.5	79.1	No Action + SDI
510	85.5	85.1	84.5	81.6	75.5	73.8	75.5	78.9	80.3	83.9	87.6	89.5	79.4	No Action + SDI + NDSS + SDSS

E-015525

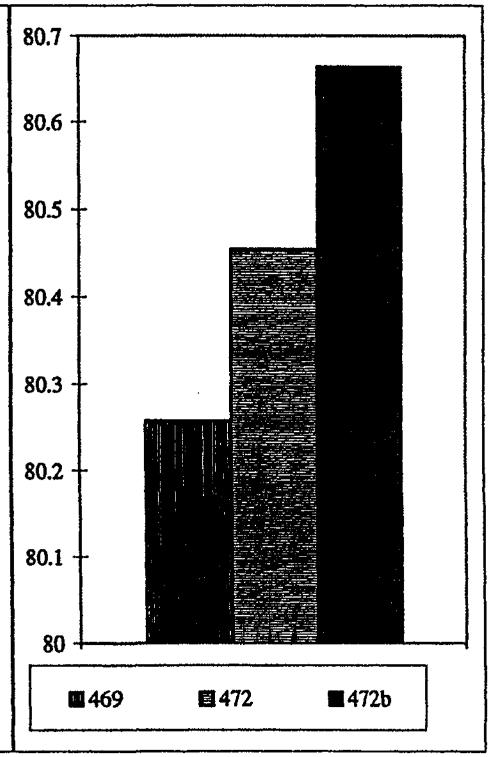
Comparison of Computed X2 Position Under Various Delta Alternatives

Data Selected from WYear1928 thru 1934

Average Monthly Values



Average NOV thru JUN Average Values



Case	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	SUMMARY	Case Description
469	88.1	86.2	84.7	81.1	77.3	76.0	77.2	79.7	79.9	84.3	87.0	89.3	80.3	Existing Conditions
472	86.7	87.1	84.9	80.9	77.2	76.2	77.3	79.7	80.4	84.4	88.1	89.7	80.5	No Action
472b	86.7	87.1	85.1	81.9	77.5	76.3	77.3	79.7	80.4	84.4	88.1	89.7	80.7	No Action + SDI
510	86.7	87.1	85.1	82.0	77.6	76.5	77.4	79.7	80.4	84.4	88.1	89.7	80.7	No Action + SDI + NDSS + SDSS

MWD-BDGM-9/22/97-10:27 AM

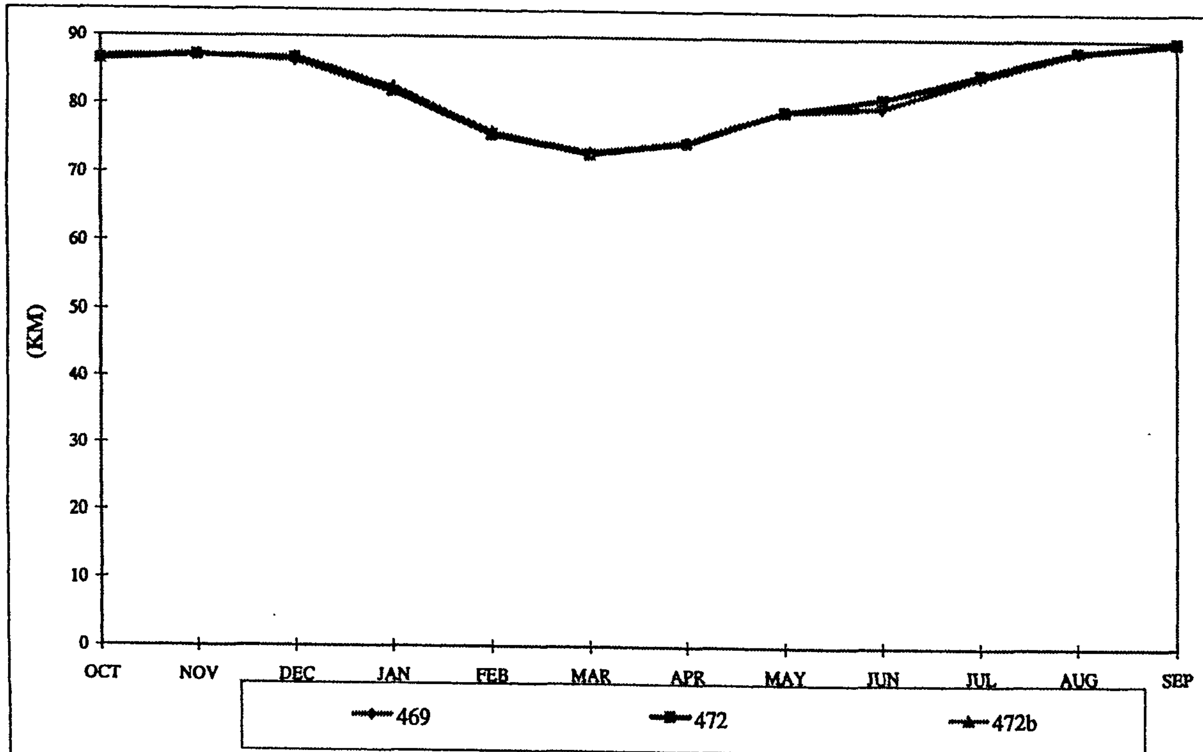
E —0 1 5 5 2 6

E-015526

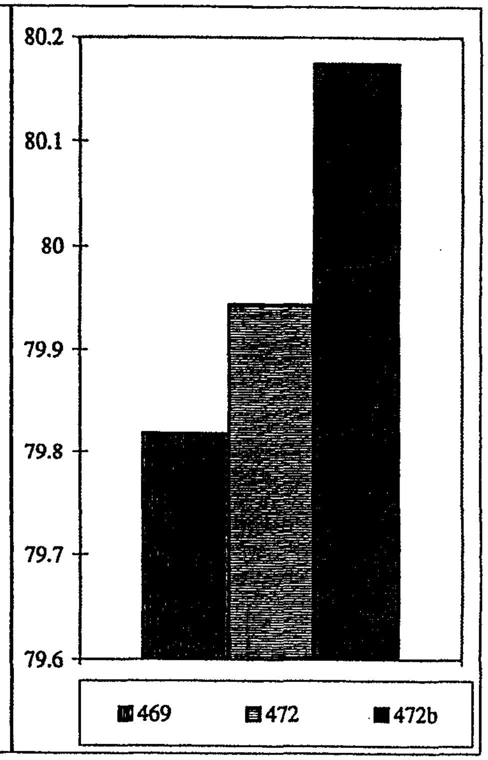
Comparison of Computed X2 Position Under Various Delta Alternatives

Data Selected from WYear1987 thru 1992

Average Monthly Values



Average NOV thru JUN Average Values



Case	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	SUMMARY	Case Description
469	87.0	87.4	86.4	81.9	75.9	73.0	74.8	79.3	79.9	84.5	88.1	89.6	79.8	Existing Conditions
472	86.5	87.2	86.8	81.9	75.7	72.9	74.5	79.2	81.1	84.9	88.4	89.6	79.9	No Action
472b	86.5	87.2	87.0	82.7	76.1	73.3	74.7	79.3	81.1	84.9	88.4	89.6	80.2	No Action + SDI
510	86.5	87.2	87.0	83.6	76.5	73.6	74.8	79.3	81.1	84.9	88.4	89.6	80.4	No Action + SDI + NDSS + SDSS

MWD-BDGM-9/22/97-10:25 AM

E — 0 1 5 5 2 7